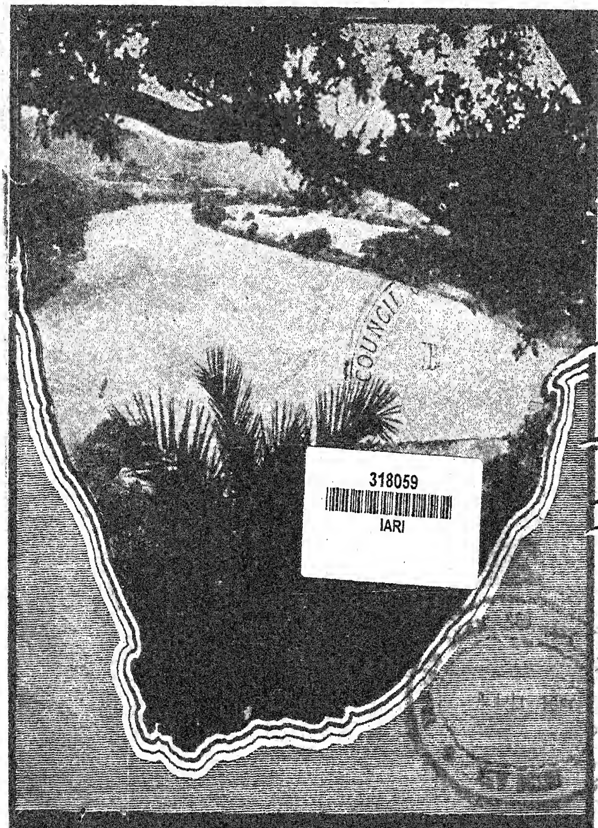
VOL. 18 No. 202 JANUARY 1943

FARMING in South Africa

(Incorporating "Crops and Markets")

Registered at the G.P.O. as a Newspaper



THE DEPARTMENT OF AGRICULTURE AND FORESTRY

5s. PER ANNUM, 6d. PER COPY

PRINTED IN THE UNION OF SOUTH AFRICA BY THE GOVERNMENT PRINTER, PRETORIA.

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[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

New Conditions and the Agricultural Industry.

Report of the Department of Agriculture and Forestry and Food Control Organization for the Year Ended 31 August, 1942.

Dr. P. R. Viljoen, Secretary for Agriculture and Forestry and Deputy-Controller of Food Supplies.

As in the case of practically all sections of the community, the past twelve months were a period of considerable changes and fluctuations for the farming community of South Africa. Directly or indirectly the causes of all this must be traced to the manner in which nature made its influence felt during the period under review

This year it is impossible, unfortunately, to publish the usual Annual Report of the Department, owing to the shortage of paper. Since, however, the activities of the Department and the Food Control Organization are of such great importance to farmers and other sections of the community, a summary of the work done in connection with the most important agricultural and food-control matters is published in the place of some of the articles which ordinarily appear in "Farming in South Africa". A large part of this and the February issue will be devoted to the summary.

and to the more pronounced effect of the war on the agricultural economy of this country. Consequently, it is largely against a background of natural visitations and the intensified effect of war that the experiences of the farmer and his industry during the past year must be sketched.

Drought and Army Worms.

The year 1941/42 showed once again to what climatic extremes the agricultural industry of South Africa is exposed. While the winter-rainfall area experienced unprecedented heavy rains, large parts of the summer-rainfall area again fell a prey to the farmer's greatest enemy, namely, those protracted and devastating droughts which always recur with inexorable certainty in this country.

Although the abnormal rains in the western Cape Province also caused damage in certain respects as, for example, in the case of the deciduous fruit crop, their general effect on the agriculture of that area was mostly beneficial. This is borne out, among other things, by the good wheat crop harvested in practically all the wheat-producing areas of the western and south-western Cape Province.

In the summer-rainfall area, however, matters were quite different. Although it cannot be said that the *drought* of the past year was as severe as that of 1933, especially in view of the fact that stock-losses did not occur on such an extensive scale and that it did not coincide with a serious financial depression, it is, nevertheless, no exaggeration to declare that it was one of the worst droughts experi-

enced by the country during the past forty years. How severe the drought really was may be gauged from the fact that during last November and December, two of the most important months for the summer-rainfall area from a sowing point of view, more than 90 districts were on the list of drought-stricken areas. Had it therefore not been for the important fact that the present economic position of the agricultural industry is considerably stronger and more favourable than was the case during the depression years, this drought would again have shaken the very foundations of agriculture. The strengthened and greatly improved economic position in which the industry found itself, however, contributed in no small measure towards the amelioration of the exhaustive effect of the drought and, above all, towards the prevention of financial ruin among our farmers on any considerable scale.

Nevertheless, the drought had a very serious effect on the industry. In the first place, the grazing in many parts of the country was so adversely affected that the feed available for livestock was wholly inadequate. In view of the limited supplies of stock feed, and especially of maize, this shortage could not be supplemented. Not only did this restrict the normal increase in the country's livestock population, but it also caused a decline in the production of animal products. In this connection mention may be made of such products as meat, butter and milk, the production of which was seriously curtailed by the drought.

Equally serious was the effect of the drought on crop and fodder production. The wheat crop for 1941/42 was poor in the Orange Free State and the north-eastern Cape Province, both as regards quantity and quality. This necessitated the institution of a seed-wheat loan scheme by the State for the season 1942, in order to assist producers who could not afford to purchase their own seed requirements, to obtain seed and fertilizer. To that end a maximum loan of £50 per applicant was granted, and no fewer than 70 districts received assistance under the scheme.

Maize production, in particular, suffered very severely as a result of the drought. As late as the middle of December it was by no means uncommon in certain parts of the maize-growing area to see large patches of uncultivated land which had not yet been planted. Many parts received insufficient rain to ensure anything like a normal maize crop and in others the rains fell very late. In regard to the latter group of districts, it should be pointed out that, as in the case of the wheat industry, the State also stepped in and assisted the farmers concerned. A scheme was instituted under which tractors borrowed by the Department of Defence and the Provincial Administrations were placed at the disposal of farmers at 4s. per morgen so that as much maize as possible could still be planted. This scheme proved a great success, and there is no doubt that the crop would have been still smaller if this measure had not been introduced.

The drought still prevailed in certain districts when the agricultural industry was afflicted by yet another visitation of nature, namely, the *army worm*, which again made one of its sporadic appearances in large parts of the Orange Free State and the Transvaal, and caused considerable damage to maize, fodder crops (especially teff) and grazing. Subsequently, the pest also occurred in a few districts in the Cape Province. The large-scale outbreak of this pest during the latter half of a dry summer naturally had a hampering effect on

agricultural production, and further greatly complicated the difficult question of providing fodder and pasturage for the winter.

Control of the army worm is an extremely difficult matter, but the Department nevertheless disseminated the best possible advice among farmers and did its utmost to inform them of the measures which could be applied to combat the pest. It may be mentioned here incidentally that, by means of research, the Department is doing everything in its power to evolve an effective method of control.

In order to alleviate the stock-feed position for the winter as far as was possible, a relief scheme was also instituted for the districts heavily infested with the army worm. In areas where the seed-wheat loan scheme was already in operation and the army worm had caused severe damage, the maximum amount of the loan was raised from £50 to £75 per applicant, thus enabling farmers who could not pay in cash for rye, barley or oat seed for winter feed production, to obtain a loan of £25 for this purpose. In districts where the pest had made its appearance and to which the seed-wheat scheme was not applicable, a loan to a maximum of £25 per applicant was also granted. Under this scheme about 50 districts were assisted, a fact which is sufficient to emphasize the importance of the scheme, as well as the magnitude of the outbreak.

If we want to summarise the production position from the point of view of Nature's influence thereon, we can therefore arrive at no other conclusion than that the unfavourable climatic conditions were by far the most important cause of the reduced agricultural production of 1941/42.

Import Difficulties with Agricultural Requisites.

Unfavourable climatic conditions, however, were not the only cause of the decreased production. In his task of production, the farmer requires not merely the natural resources, namely, soil, stock, veld and water. Agricultural production under present-day conditions has become dependent on a great diversity of requirements, among which need only be mentioned to emphasize this point, articles like agricultural machinery and fertilizer. Although agriculture in the Union is by no means mechanized to the same extent as that in many other countries, its requirements in respect of additional instruments of production are already exceptionally diverse to-day, so much so, that even in the case of the average farmer, these instruments have become an urgent necessity for the successful prosecution of his farming activities. Owing to the influence of the other principal factor—the war—on agriculture, farmers were unable to procure adequate supplies of their normal farming requisites and instruments of production during the past year. To a certain extent this also had a hampering effect on production, as will be seen in the following chapter where this matter will be discussed more fully.

An Enormous Increase in Consumption.

Simultaneous with the smaller production consequent upon the conditions created by the war and the drought, the country was suddenly faced with another problem, namely, an *enormous increase in consumption*. Quite apart from the much greater outlet which the agricultural industry has secured as a result of the present large-scale industrial developments, the whole position of supply and demand, in so far as food products are concerned, actually underwent a very material change within the period of four or five months during which the drought prevailed.

It is a generally recognised fact that in the years before the war the one great agricultural problem in South Africa was the *question of surplus supplies*—the problem of obtaining a sufficiently large and remunerative market for the agricultural products which we produced in excess of our own requirements. Not only is it a notable achievement for the agricultural industry to have made the Union self-sufficient during the past fifteen to twenty years in so far as the primary food products are concerned, but the export market also assumed the greatest importance during that period.

It is frequently asserted that this surplus is an "economic" and not an actual surplus, and that the entire production *can* be consumed locally. This is by no means the case, however. The surplus was real and we cannot get away from the fact that for quite a number of years this country produced more agricultural products than could be consumed within its borders in the form of food or absorbed as raw materials for industrial purposes. Export was therefore unavoidable and indispensable. Even during the first two years of the war the export market continued to occupy a very prominent place among the outlets on which we were dependent.

Owing to the decrease in production as occasioned by the drought, and the increase in consumption, there was a sudden reversal in the position, with the result that *conservation of food supplies and the adoption of effective measures to satisfy all the requirements which must be met from this country's agricultural production became the primary consideration*. In point of fact, the position changed to such an extent that, except for deciduous fruit, which we cannot export, and citrus and dried fruit, no food products at all were available for export. The main question during the past year was therefore not where or how we were going to export, but what we should do in order to satisfy the requirements of all the channels of consumption which depend on the Union's agriculture for their supplies.

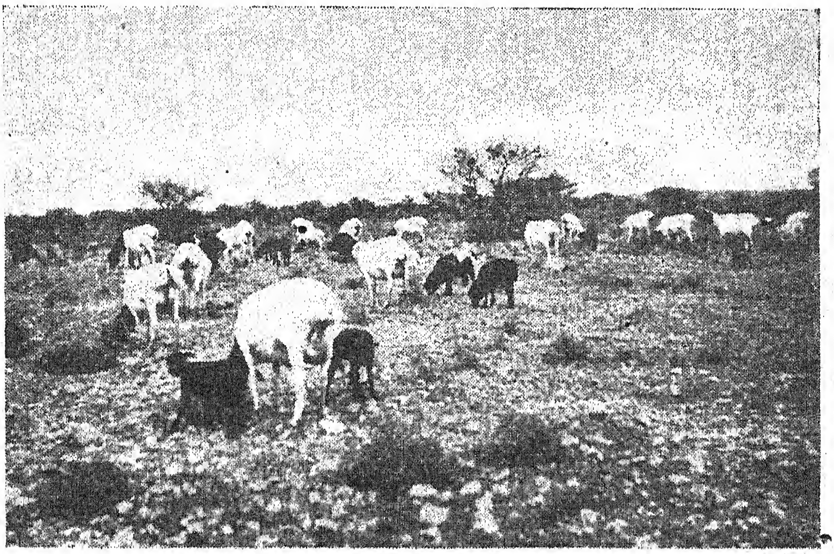
A Far-sighted Policy Proves its Value.

That it was possible under these circumstances to avoid any considerable food shortage, must in the first place be ascribed to the policy which has been pursued during the past number of years in regard to agriculture. In this respect, special mention must be made of all the work which has been done to strengthen the foundations of the agricultural industry, both as regards production and marketing. Measures such as those adopted in connection with erosion control, stock improvement, veld conservation and weed control all played, and continue to play, an important part in so far as the re-inforcement of the inherent production capacity of the agricultural industry is concerned. Had it not been for this constructive work, the drought, for example, would have struck the industry a much more serious blow, with consequently aggravated repercussions on the scope of production. In addition, there is all the work done under the Marketing Act for better organized and more orderly marketing. There can be no doubt, that, if the sudden increase in consumption had occurred five or six years ago when marketing conditions—and this may well be candidly admitted—were still largely in a state of confusion, regulation and the most economical utilization of supplies would have been an almost impossible task. Since the agricultural industry has to re-adjust itself within so short a period to the changed requirements in regard to production and consumption, the fact must be emphasized that this adjustment is being facilitated by an agricultural policy which is purposefully

directed at the establishment of a more productive and stronger agricultural industry—an industry with the inherent strength to meet the demands of increased consumption.

Reasons for the Increase in Consumption.

Mention has already been made of the restrictive influence exercised by the drought and the war on the production of food products. It is also necessary to devote some attention to the reasons



Persian ewes and lambs (S.D.x. Romney).

for the tremendous increase in consumption, because only then can we see the developments of the past twelve months in their true perspective.

It is a well-known fact that since the outbreak of war there has been an appreciable increase in the consumption of practically all agricultural products. Even during the first year there was a perceptible increase, as was to be expected in a country which was mobilizing itself for war. As South Africa's war effort was intensified, the size of its fighting forces expanded and the extent of its war requirements increased, so the demand for food became ever greater. Indeed, this factor alone is responsible for an enormous increase in the demand for agricultural products, and the more comprehensive the war activities of the Union become, the more exacting will be the demands from this quarter upon our food supplies.

Gradually additional factors emerged to drive up consumption. There are, for example, the convoys and other ships which touch at our ports in order to take in supplies; there are the thousands of evacuees who are staying in the country at the moment and who depend for their food upon the supplies obtainable here; there are the prisoners of war who must be fed; and, finally, there is the stimulation of consumption which results from the fact that the war and the payment of higher salaries and allowances have brought a much larger amount of money into circulation among many of the country's inhabitants.

Furthermore, the drought also played an important part in increasing the demand for certain products, particularly fodder products such as maize, lucerne and teff. The shortage of natural grazing simply compelled farmers to resort to feeding, and that during a period when fodder products were scarce. In addition, there was the fact that stock farmers, especially dairy and poultry farmers, who use concentrates as a normal farming practice, experienced considerable difficulty in procuring adequate supplies in an endeavour at least to maintain production at its normal capacity and thus to satisfy the increased demand for products such as milk, butter and eggs. This inevitably imposed an additional strain on supplies.

Importation of Food Products also Difficult.

Under ordinary circumstances, it would have been easy to supplement any possible shortage in local requirements by importing them from oversea. In view of the difficult shipping position, however, the importation of food products, just as in the case of farming requisites, has become a serious problem. Actually, the position in regard to shipping facilities has deteriorated considerably in comparison with the conditions which obtained during the first two years of the war. An appreciable measure of success was admittedly achieved with the importation of wheat for supplementing the inadequate local production, but difficulties were experienced especially in connection with the importation of the few important food products which are either not produced in the Union at all, or only on a very small scale. An example of such a product is tea, the consumption of which is very considerable. In order to ensure equitable distribution it was necessary to institute a mild form of rationing in the case of this article. Similar measures may be necessitated later with foodstuffs falling under this category.

The Food Controller and Food Control Organization.

It must be clear from the foregoing that the problems which originated from decrease in production and importation on the one hand, and the great increase in consumption on the other, were of such a nature that it was impossible for the re-inforced agricultural industry alone to cope with the situation. Special measures became imperative. The Government did not hesitate, but immediately took the necessary steps.

These steps were embodied in the appointment of the Minister of Agriculture and Forestry as *Controller of Food Supplies* and the Secretary for Agriculture and Forestry as Deputy Controller who are assisted by a *comprehensive food control organization*. This new development is by far the most important event in the field of agriculture during the past year.

From what has been said thus far regarding the underlying causes of the establishment of the Food Control Organization, it is clear that those causes are so wide in their scope and implications that extensive powers had necessarily to be conferred upon the Food Controller. To put the matter briefly, he may exercise the following powers: grant financial assistance for the promotion of production; fix prices; control marketing by operating as buyer or seller himself, or by regulating in other ways the distribution and utilization of food supplies; regulate and take over the provisioning of ships and the fighting forces; and assume control or regulate in some other way the use of refrigerating or other storage facilities. In the execution of his duties the Food Controller is advised by an Advisory Food

Supplies Board on which all the interested sections are represented. It must be stated further that in view of the cardinal importance of agricultural machinery and implements, as well as of fertilizers, a Controller of Agricultural Implements, Machinery and Requisites and a Controller or Fertilizers were appointed. The latter functions under the Food Controller, and although the former falls under the Department of Commerce and Industries, the control over agricultural machinery, implements and requisites constitutes, for all practical purposes, an integral part of the Food Control Organization.

In the next chapter more detailed information will be given on the activities of the Food Control Organization and cognate organizations. Consequently, only their general aims and objects will be briefly outlined here.

The functions of the Food Controller in themselves provide an indication of the duties entrusted to him and his organization. *The preconceived task* of the organization *is the stimulation of food production* on a selective basis, that is, in the directions in which the need is greatest. The fact must be emphasized in this connection that the demand in no way exceeds the total production capacity of the Union, provided climatic conditions are normal and production is judiciously planned and carried out. Moreover, increased production does not necessarily connote the practice of a system of exploitational cropping and overtaxing of the natural powers of agriculture. On the contrary, it is fully realised that such a course of action would not only be a negation of the general reconstruction policy of the Department, but that it would also eventually result in the complete exhaustion of the industry as such. Due consideration is therefore given to this important matter in the plan to increase production, and steps are being taken to ensure that, as far as is possible, increased production will not involve the impairment of the basic resources of agriculture. It is feared, however, that under the present war-production conditions when such exacting demands are made on agricultural soil, it is impossible to avoid exploitational cropping, and that no matter how detrimental this may be for the future, soil exhaustion will certainly take place on an extensive scale.

The stimulation of production is brought about in several ways. There is, in the first place, the *advance announcement of prices* which are to be paid for certain products. In this connection reference may be made to wheat, maize, cream and cheese milk. It is necessary to stress the fact, however, that this method is not always practicable or even desirable. In the advance determination of prices account must be taken of a large number of factors which may vary from time to time and necessitate a change of policy. Moreover, prices cannot be fixed in advance for all agricultural products, particularly where the seasonal factor plays a decisive rôle, as for instance, in the case of potatoes and vegetables.

Nevertheless, the importance of the price factor in the production campaign is fully appreciated. Consequently, it remains the definite policy of the Department and of the Food Controller to assure to the primary producer, within the general framework of the Government's price policy of counteracting inflation and checking speculation with the nation's food, a price which, over and above a reasonable reward for his own work, will compensate him for the increased production and living costs and still leave him a fair share. With this end in view, a *Price Committee* was instituted under the Food Control Organization in order to advise the Food Controller and

the Price Controller on matters pertaining to price fixations in respect of agricultural products. In all its calculations this Committee goes out from the standpoint that the farmer must obtain legitimate remuneration for his difficult task of production under prevailing conditions.

Next, there is the *Purchasing Section* which was set up with a twofold purpose under the Food Control Organization. By undertaking on a considerable scale the purchase of certain food products for military camps and controlling the provisioning of ships and convoys, it obviates, in the first place, the dislocating effect which these factors could have on the market. In the second place, it serves as a very valuable price-stabilizing medium for seasonal products, like eggs, potatoes and meat, so that a temporary glutting of the market does not result in such a sharp fall in prices as is usually the case. Experience has already shown that this section is making a valuable contribution towards the general policy of assuring reasonable prices to farmers.

The policy of assuring reasonable prices for agricultural products is, however, not the only means employed by the Food Controller for the encouragement of agricultural production. Apart from the establishment of direct facilities such as, for example, the institution of a loan scheme for the purchase of groundnut seed, an important part of the campaign includes the furnishing of advice and guidance on a nation-wide scale to farmers in the different production areas.

Such guidance and advice are provided in an intensive manner and, with this object in view, a special *Publicity Section* was inaugurated. By means of the radio, press, special articles, the arrangement of special " production " tours, and the attendance of representatives of the Department to farmers' meetings and agricultural congresses, it is ensured that farmers are kept informed, almost from day to day of what and how much they must produce, how they must set about matters to obtain the best production results, and what must be done to surmount their obstacles.

Almost of equal importance is the task of the Organization to place distribution and marketing on a more orderly footing. In this respect it is fortunate that, since the adoption of the Marketing Act in 1937, various control boards have been established which have already been able to do much towards solving the difficult problem of orderly marketing and equitable distribution. The Food Controller makes use of these existing bodies wherever necessary, increased powers being assigned to them if this should prove essential. The Mealie Industry Control Board, for instance, plays a prominent part in the special distribution system which had to be devised for this important product in consequence of the smallness of the crop, and for that reason the Board was invested with additional powers. The Wheat Board also fulfils an extremely important function in connection with the supply and distribution of wheat, particularly in regard to importation, the conservation of supplies and the regulation of distribution. Under the Wheat Control Scheme, however, the Board has adequate powers to carry out this work effectively. Apart from the Boards, the Food Controller also makes use of the ordinary *channels of trade* in the execution of his distribution plan. As already indicated this plan is not confined to locally produced food products, but is designed to include all kinds of foodstuffs where the supply position justifies regulated distribution. Fortunately, rationing measures have hitherto been necessary only in the case of

maize and tea, and although it is hoped that circumstances will not necessitate special measures in respect of other foodstuffs, the Food Controller will not hesitate to take appropriate steps.

The fact that use is made of the ordinary channels of trade is specially emphasized here because lately assertions are so frequently made to the effect that it is the object of the Department and the Food Control Organization to eliminate the trade. Nothing could be further from the truth and this is definitely not the policy of the Department or the Organization. It will be realized, however, that as a result of those war conditions which necessitated special steps for the conservation of supplies, the supplementation of shortages, and, in certain respects, the application of rationing, the position of the trade, just like that of various other sections of the community, has been unavoidably affected. There has never been the least intention, however, of any deliberate elimination.

During the short period of its existence, the Food Control Organization has not only demonstrated its value, but has also shown that such an organization has become indispensable in regard to the solution of the numerous aspects of the food problem in the abnormal times we are witnessing at present. Indeed, it is to-day, *already an organization of national importance*. For the producers it has become the source of inspiration of the country's wider and more systematized production activities and the agency making for the greatly improved prices they obtain for their products, while for the consumers it is the pivot around which their food supply now revolves. In point of fact, the Organization is just as important for the consumer as for the producer since, in addition to the provision of food itself, it means for the former a more equitable distribution as well as the prevention of wastage supplies.

Normal Activities.

While so much has been said on the food problem and the Food Control Organization, it should by no means be inferred therefrom that the other normal activities of the Department have been neglected. There has, of course, been a considerable reduction in the personnel of the Department owing to the large number of officers who have enlisted for military service thus necessitating the curtailment of activities in certain fields. This is an unavoidable concomitant of the prevailing war conditions. In this connection the fact should also be strongly stressed that the emphasis of the Department's activities has shifted to food production and that a curtailment of operations in other directions has followed in consequence. If, therefore, the activities of the Department are viewed as a whole, there is in reality every reason to be satisfied that, in spite of the abnormal conditions, so much of real importance could still be done for the farming community.

Although on a reduced scale, agricultural research, the mainstay of the work designed to solve the farmers' problems, was actively continued in all the most important directions, and in several respects as, for example, in connection with blowfly control. The results achieved were of the greatest significance. In regard to the work for strengthening the basic structure of agriculture it should be mentioned that not only did the Department continue with the activities connected with such problems as weed control and grass and pasture research, but a start could also be made with the carrying out of its reclamation programme in the Vlekpoort Conservation Area. It was

also found possible to re-introduce, on a modified basis, Soil Erosion Scheme A, which, together with the other soil erosion schemes, was suspended in June, 1940. The silo scheme was also put into operation again. In this particular sphere, therefore, highly valuable work was once again carried out.

During the past year the deciduous fruit farmers witnessed the completion of the Fruit Research Institute at Stellenbosch—a new milestone in the history of deciduous fruit research in this country. Certain aspects of the distribution problem were also investigated by a Departmental Committee on behalf of the deciduous fruit industry. Wheat farmers, on the other hand, had the benefit of the exhaustive investigation instituted by the Wheat Commission into their industry, and although events developed so rapidly that some of the recommendations made by the Commission are impracticable under the prevailing circumstances, the report of this body is an extremely valuable document with a view to a long-term wheat policy. The Commission did not lay down a war policy for wheat but attempted to determine a future policy for that industry, and more will certainly be heard of the findings of this body when conditions are normal again.

In so far as the livestock industry is concerned, the railage-concession scheme for the conveyance of stock from, and fodder to, proclaimed drought-stricken areas was continued. In view of the severe drought, this scheme was once again instrumental in saving the lives of thousands of animals. The important work which is being undertaken in connection with stock-improvement was also carried a step further, and during the year a number of new districts were declared cattle-improvement areas.

The Year as a Whole.

If, after this review of the varying events, sudden changes, distressing climatic conditions, favourable and unfavourable effects of the war, and the different remedial measures applied, an opinion must now be expressed on the general economic position of the farming community during the past year, we can arrive at no other conclusion than that 1941/42 was a difficult year for the farmers of this country. The general exhaustive effect of the drought was too great and the total agricultural production too small for the year to be regarded as good. Then there was the shortage of labour which was felt to an increasing extent in many parts of the country, as well as the scarcity of labour-saving machinery which made the task of production more difficult for the farmer. It should also be borne in mind that our farmers had at the same time to cope with the vexed problem of steadily increasing production costs, a problem which is difficult to cope with at the best of times and which becomes all the more harassing during periods of low production. There was therefore no lack of difficulties, obstacles and adversity.

On the other hand, however, it would be quite wrong to describe 1941/42 as a bad year for the farmers. There were undoubtedly certain factors which contributed in no small measure to the mitigation of the ill-effects of the adverse factors, to such an extent indeed, that despite the hampering effects of the drought and high production costs, most farmers were still able to derive a fair and reasonable income from their undertakings. Two factors in particular were responsible for this, namely, the reasonable prices which, on the whole, were realized for agricultural products as a result of the

stimulating effect of the demand in relation to the supply and, secondly, the steps taken by the Government for the stimulation and stabilization of prices.

A market where the farmer can dispose of his products at reasonable prices is one of the most indispensable requirements for his economic welfare—and that market and those prices the great majority of the farmers in the Union enjoyed during the past year. The extent of the local outlet as created by the abnormal demand, which the Union's agricultural production had to satisfy, is naturally of a temporary nature and no one should be so short-sighted as to imagine that it will always be so great. The fact remains, however, that during the past years our farmers enjoyed the benefit of that market and of the prices attached to it. What is more, it was no export market which had to be found overseas and which was subject to the impediments being experienced to-day in connection with shipping facilities. The market was here, in our own country and at our own ports.

Furthermore, there is no doubt that the farming community as a whole is still in a sound financial position and that the general financial foundation of agriculture continues to be solid. Very few cases of insolvency are occurring and there is certainly no spirit of pessimism prevalent among our farmers. On the contrary, the year was characterized by great activity on the part of the farming community, an activity which found expression in increased efforts at production and a perceptible desire to harness hitherto unused instruments of production in the national interest.

And what of *the coming year?* We are living in troublous times and the future cannot be fathomed. There appears to be little doubt, however, that great difficulties still lie ahead. One of the most serious of these is the supply of the agricultural requisites which farmers require. In this respect we are, unfortunately, almost exclusively dependent on importation, and in view of the shipping difficulties it stands to reason that the problem is no easy matter to solve. Farmers may rest assured, however, that the Government will do evrything it possibly can in this matter. Agriculture always has been and remains a key industry and, as in the past, it will continue to be treated as such.

One thing is certain: the demands which will be made upon the Union's agricultural industry in the fields of food production during the coming year, will be just as great as those of the past year. The logical conclusion which must be drawn from this is that the strong demand for food products will continue, and that our farmers must not relax their production efforts. On the contrary, production and still greater production must be the dominant feature of their activities. Here, however, the vagaries of nature will be the decisive factor. Much, so very much, depends upon the amount and time of arrival of the summer rains. If we are destined to experience another protracted drought, the position will undoubtedly become very critical and serious. We stand on the threshold of the new summer season; the realities of the coming months remain shrouded in darkness for us. Together with the thousands of farmers in South Africa, the Department fervently hopes, however, that we shall have a prosperous and rainy season. If that hope is fulfilled, many of our present problems will solve themselves on the green fields and fertile lands of South Africa.

II. The Activities of the Food Control Organization.

IN reviewing the activities of the Food Control Organization, due account must be taken of the fact that it is an organization which had to be established with speed and that it has now been functioning for only a few months. Nevertheless, the fact must be put on record that the organization as such was not only built up in an effective and well coördinated manner, but that it has also become an indispensable part of the machinery required to safeguard the interests of both consumers and producers in this country in so far as food questions are concerned.

At the head of the organization stands the Controller of Food Supplies, Colonel W. R. Collins, Minister of Agriculture and Forestry. He is assisted in the execution of his duties by the Deputy Controller of Food Supplies, Dr. P. R. Viljoen, Secretary for Agriculture and Forestry, and, in addition is served with advice by a Food Supplies Advisory Board. The various sections which constitute the executive machinery of the organization are the following:—

Production Section: Director, Prof. A. M. Bosman.
Marketing and Distribution Section: Director, Prof. J. F. W. Grosskopf.
Purchasing Section: Director, Prof. I. S. Fourie.
Publicity Section: Director, Prof. J. S. Marais.
Price Committee: Chairman, Dr. C. H. Neveling.
Fertilizer Control: Controller, Dr. J. P. van Zyl.
Cold Storage Control: Officer-in-Charge, Dr. G. M. Dreosti.

Besides these sections there are various committees, such as, for example, the Feeds Committee and the Statistics Committee which assist some of the directors in the carrying out of their functions. The Director of Production also has technical advisers for the various branches of farming falling within his province, and, in order to encourage production more directly, there are, in addition, 8 coördinating regional officers who function under him for the various agricultural areas of the Union.

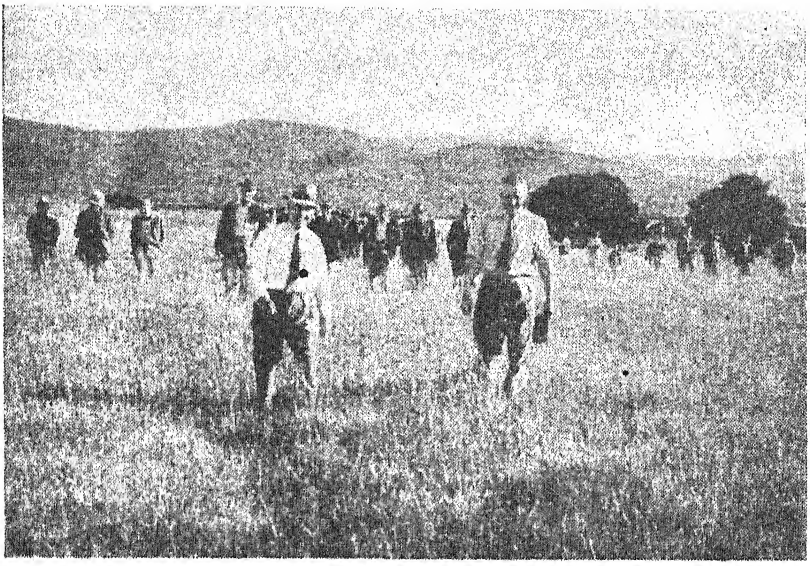
Prices and Price Policy.

Since price is, after all, the decisive factor in connection with production, and especially increased production, it is just as well to commence with a brief review of the broad principles underlying the work of the Price Committee in its task of advising the Food Controller and the Price Controller on price questions. It is not the intention to enlarge here upon the individual prices of various agricultural products. Information on this subject is furnished in those parts of the report where the products themselves are dealt with. Here only fundamental price questions are discussed.

In the application of a sound price policy under the prevailing circumstances, particular attention must be given to the relative position of every industry and every product in the present national economy, the factors to be taken into consideration in order to regulate prices in such a manner that they are reasonable to both producers and consumers, and to the need for counteracting inflation.

Let us take the last point first. It is a well-known fact that war conditions always have a strong inflationary effect which, unless

timely precautionary measures are taken, ultimately reaches a breaking point with disastrous results not only for the country as a whole, but above all for the group or industry which temporarily enjoyed the excessive prices. At the outbreak of the present war the world was still struggling to shake off the cumulative effect of the burdens arising from *the inflation prices which followed the First World War*, and the tremendous collapse and dislocation which characterized the post-war period. Indeed, there was not a single country



Inspection of grassplots in the district of Ixopo.

which had completely rid itself of the consequences of that devastating world-wide catastrophe when the Second World War broke out.

Although they had never completely recovered from the adverse effects of this inflation, the countries of the world had fortunately learned a lesson from it, a lesson which they are now vigorously applying during the Second World War. Throughout the world to-day it is the recognised policy of all countries to control prices and to keep them within reasonable bounds. There was, in fact, no other alternative left to them. Having regard to the future, every country, and this applies to South Africa as well, was simply compelled to take every possible step within the framework of its national economy to prevent or counteract a new attack of inflation. It is, therefore, the definite policy of the Government to prevent inflation and to check speculation, and although the fullest measure of success is not being achieved in all respects, the Government's policy in this connection remains firm and unchanged. Indeed, it is difficult to imagine how serious our present position would have been if timely measures for the application of such a policy had not been put into operation and the prices of both industrial and primary products had been allowed to soar to excessive heights.

In regard to agricultural products, the fact should also be borne in mind that at the outbreak of war, and even as short a while ago as last year, we were still producing considerable agricultural surpluses for the disposal of which we were almost entirely dependent

on the British market. We had therefore to take into due account the price controlling measures instituted by Great Britain immediately after the outbreak of hostilities. Except in the case of a few products, however, these surpluses have now disappeared, with the result that, at the moment, our greatest problem is the question of increased supplies; but, quite apart from the unavoidable repercussions which a policy of excessively high internal agricultural prices must ultimately have, we dare not lose sight of the fact that export will once again become a matter of paramount importance for our agricultural industry and that we must therefore attach the greatest value to the maintenance of a price level which will not give other agricultural-producing countries a dangerous start on the world market after the war. In addition, it should be borne in mind that world-market prices will then be considerably lower than the prices being realised at present for most agricultural products and that it will be a shock to agriculture if it had suddenly to adjust itself from a position of high prices to a position of lower prices. The question of price relationships with a view to the post-war position is therefore a matter to which earnest consideration must be given even at this stage.

If, therefore, in dealing with the present problem of agricultural prices due attention is given by the Government to the dangers of inflation as occasioned by excessive prices, it is merely rendering a service to the future of the agricultural industry in South Africa. No one can dispute that fact. It is definitely not a policy of keeping down prices because all reasonable and sound increases in price are being allowed. The intention is solely to guard against dangerous excesses in the price sphere, and the measures taken aim at nothing but the furtherance of the welfare of the nation.

Having stated these facts, however, it is also necessary to return to the first point and to examine *the position occupied by the agricultural industry and its products in our present national economy*. In view of the fact that it must satisfy the greater part of the requirements of the manufacturing industries and at the same time provide food for the nation, the Union's agricultural industry has always been and continues to be a key industry. Since the outbreak of the war it has gained still further in importance, because to-day, owing to the import difficulties, the country must to a greater extent than ever before depend upon its own production, both for food and for industrial purposes. This is a fact which should not be lost sight of in connection with agricultural prices, as it means in reality that war conditions have accorded a greater relative value to the agricultural industry and to agricultural products. This fact in itself entails that agricultural products have gained a higher status and that they command a higher value than before the war. This is an aspect of the general problem which is constantly being kept in mind in dealing with price questions.

Then there is the problem of *the relative importance of the different agricultural products*. Even in time of peace the rôle and the functions of any particular branch of the agricultural industry do not necessarily remain the same. In a broad sense this may be the case, but as the economy of a country develops practically every branch of farming undergoes, to a greater or lesser extent, a change in respect of the position it occupies in that economy. In time of war the rate of that change is usually greatly accelerated, and products which previously occupied a minor position may then come into greater prominence. In point of fact, a considerable

change may occur in the relative position of such products. By way of illustration we need merely mention vegetables and deciduous fruit. The war has given a much more prominent rôle to the former, while the part of deciduous fruit has declined in importance, due to the large export surplus for which there is at present virtually no export market. This point must be and is being borne in mind, in dealing with prices.

This brings us to the second and most important point, namely, *the factors to be taken into account in the regulation of prices of agricultural products with a view to ensuring equitable treatment to both producers and consumers.*

Beginning with the producer, we have naturally in the first place to face the fact that his production costs have risen considerably since the outbreak of the war and that those costs continue to show a rising tendency. There are various reasons for the increase in production costs but, generally speaking, they can all be traced to the scarcity or shortage of the instruments of production which, in turn, has been brought about by the war or unfavourable natural conditions. Since they are dependent on importation, requirements such as agricultural machinery and implements, cream cans, fertilizer, fuel, dips and sprays have all become much scarcer and also much more expensive as a result of the war. The same applies to labour which is such an important factor in production. In so far as the adverse effect of climatic conditions is concerned, feeds of various kinds are very scarce following upon the drought of last year, and most farmers who normally produce their own supplies of feed, had to purchase their feed requirements at high prices this year. Indeed, so serious did this problem become that for the protection of producers themselves the Price Controller, in consultation with the Food Controller, had to fix maximum prices for lucerne and teff grass (at 6s., 5s. per 100 lb. respectively). Furthermore, the production costs of stock farmers who have to make use of concentrates and protein-rich feeds, have also risen appreciably as a result of the scarcity and consequent high prices for these articles.

The Government is fully aware of the effect which increased production costs are having on the activities of the farmer, and of the necessity of coping with the position by improving the prices of agricultural commodities. As a matter of fact, it is realised that we are here concerned with one of the fundamental difficulties of the agricultural industry and that the only effective remedial measure is to assure reasonable prices to the farmer.

Moreover, the fact is frequently lost sight of that it is not the urban population alone which feels the impact of increased living costs, but that, although to a somewhat lesser extent, the cost of living has gone up for the farming community. Not only does it cost the farmer more to produce that portion of his production he himself consumes on the farm but, just like the townsman, he must also pay much more for clothing, groceries, etc. Where the townsman receives allowances to cover at least a portion of the increased cost of living, it is only reasonable that living costs must also be taken into account in determining the farmer's direct income, namely, the prices of his products.

Another matter which is of special significance this year is the fact that in the case of many farmers production was below normal. Not only did this have a restrictive effect on their total income, but it also increased the production costs per unit, particularly in those cases where expenses for production were incurred but, owing to the drought, production operations could not be carried through to their

normal conclusion. This factor, too, must be and is taken into account in the calculation of a reasonable price to the farmer.

Finally, there is the fact that, where practicable, the advance indication of prices—and of reasonably remunerative prices at that—is an accepted method of increasing production. As has already been indicated, this is possible only in the case of certain products where such a system of price control can conform to the nature of the product and to the particular position it occupies in the economic life of the country. Nevertheless, it is a factor which makes for price stimulation. The same applies to the purchasing and selling method employed by the Food Control Organization to facilitate price stabilization in another way.

While it is therefore the recognised policy not to keep agricultural prices down, but to let them rise to a level which will do justice to the influence of the factors which should actually be taken into consideration, the State cannot, on the other hand, allow agricultural prices as such or the prices of individual agricultural products to soar to a point where they will become a danger to the economic life of the country and to the agricultural industry itself. On the contrary, the State is compelled to step in where, for instance, agricultural prices climb to a dangerous level as a result of a maladjustment between supply and demand. In this connection meat may be mentioned as an example. In view of the excessive prices of meat during the past few months, the State would long since have taken action and fixed maximum prices had it not been that our meat-marketing system and the absence of grading made such a course an extremely difficult matter. Owing to the continued upward trend of meat prices, however, the fixation of maximum prices has now become unavoidable and the necessary steps in that direction will shortly be taken. In point of fact, meat prices have already reached the inflation stage and it is in the interests of agriculture and the country as a whole that a check be imposed.

Another fact of importance in connection with prices is that where the present needs of the country make it necessary for the production of certain products to be stimulated more than that of others, and consequently, for relatively higher prices to be paid for the most essential products, it is imperative that the stability of the industry as a whole should not be endangered. There exists a close relationship between the various branches of farming and due account must be taken of this relationship in price determinations. This is a further aspect of the price problem which cannot be ignored.

As regards the *consumer's side*, it must be pointed out in the first instance that the additional money brought into circulation in the Union as a result of the war, the money which came into the country along with some refugees, and the fulfilling of the needs of the Union's fighting forces have considerably strengthened the general purchasing power of the total consuming public of this country. Furthermore, the general financial position of the urban position of the Union's population has always been stronger than that of the rural community and, in addition, now that the total quantity of consumable commodities has diminished, they are prepared to pay higher prices for those commodities which are still obtainable. Indeed, it is really here, that is, in the greater purchasing power of so many individual consumers and in the reduction of the available quantity of consumable commodities that one of the principal reasons for the sustained increase in the consumption of so many products must be sought.

But the living costs of the urban consumer are already about 16 per cent. higher than before the war, and obviously full account must be taken of the relationship which exists between his increased living costs and his greater purchasing power. To put the matter differently: although it may be desirable from the national point of view for consumption to decrease in some directions, especially in regard to certain food products, a general decline in consumption would certainly be to the detriment of the primary producer. For him it would mean a skrinkage in the demand for his products which, in turn, would be followed by a decline in prices. The primary producer would, therefore, do well to remember that it is in his own interest that agricultural prices should not soar to heights where they have a restricting influence on consumption.

Thus, in so far as the consumer is concerned, the position is that the measures taken to assure a reasonable price to the farmer are also calculated to serve and protect his interests. Not only do these measures aim at satisfying his food requirements but, even though on a higher level, the prices at which those food products are supplied, are within the means of the general consuming public.

To summarize, it may be stated that there are quite a number of factors which have to be considered in a systematic appreciation of the agricultural price problem with a view to the application of a sound policy in the existing circumstances. On the face of things, some of these factors are irreconcilable with each other, but in reality this is not the case. The matter must merely be seen in all its implications and a correct perspective must be maintained. Consequently, this has always been and continues to be the method of approach of those who are charged with this difficult task.

Should we now try to assess the influence of such a price policy on the agricultural industry during the past year, we cannot but say that that influence was salutary and beneficial. Within the general policy of inflation control, it was possible to ensure that the various factors which entitle farmers to increased prices made themselves felt with due regard to their importance in the present circumstances. Our farmers experienced many difficulties, but from a price point of view there was little cause for complaint, and actually, prices were by far the most important means of neutralizing the difficulties they had to face.

Stimulation of Production.

The activities of the Production Section are wide in their scope and form, in reality, the basis of the whole Food Control Organization, namely, the production of a greater supply of food. The task is fraught with many difficulties because increased production must be achieved in spite of the factors which have a hampering effect on the farming enterprise, as for example, the scarcity of fertilizers, agricultural implements and other requisites, and the difficulty of obtaining adequate farm labour. Furthermore, the success of the campaign for increased production is closely bound up with natural conditions which are so precarious in this country.

In the execution of a policy of increased production, the principal aim is the application of improved methods of farming to a greater extent than ever before. It is the object in this connection that the dislocation of established systems of farming should be avoided as far as possible and that preference be given to those products or crops which can be produced in the cheapest and most effective manner with due allowance for the limitations imposed by soil and climate. Steps are being taken, moreover, to guard against

overtaxing of the soil and veld. In fact, it is the fixed policy that economic utilization of grazing and the maintenance of soil fertility should be one of the primary considerations of the producer.

It should also be pointed out that increased production in itself is incapable of solving all our problems. Much can be done, for example, by utilizing available food supplies more economically and by preventing waste, especially in regard to the feeding of animals. The feeding of unbalanced rations sometimes results in a considerable waste of certain valuable constituents. In this connection it should be mentioned that, on the whole, the shortage of proteins is the most serious difficulty being experienced at present, so much so, that the cultivation of more legume hay to supplement the shortage has become a matter of urgent necessity.

Crop Production.

In co-operation with the Distribution and Marketing Section, the Production Section, as one of its first steps, took possession of the *groundnut crop*, the main object being to secure seed supplies for the coming season and to ration the balance of the crop among consumers. This step was necessitated by the short crop. The measure was a complete success and the information gained with this undertaking will prove of the greatest value for the future.

Generally speaking, the crop was of very poor quality owing to the drought of last year and severely tested the new grading system which had to be instituted. The manner in which the system stood the test, however, amply justifies the hope that it will be retained even when times are normal again. In spite of the poor quality of the crop, approximately 12,000 bags of seed of good quality were set aside and made available for planting during the present season. A great deal of publicity work was undertaken in order to encourage the planting of groundnuts on a more extensive scale, and it is hoped that during the coming season the crop will at least be large enough to satisfy all requirements for human consumption. As a further inducement for the production of groundnuts, a loan scheme was instituted, providing credit facilities for the purchase of groundnut seed.

Another important undertaking is the *importation of seed potatoes*, a matter which is of considerable significance in view of the fact that the successful continuation of potato production is to a large extent dependent on imported seed. Representations were made to the British Ministry of Agriculture regarding this matter, and a quota of 1,250 tons or approximately 28,000 boxes of 100 lb. each of "Up-to-date" seed potatoes was assigned to the Union. Owing to the fact that all private importers are not prepared to bear the great risks attached to importation under the present circumstances, almost the whole quantity is being imported by the State itself in an endeavour to ensure that supplies will come into the country. Distribution will be effected according to the quantities which safely reach our ports. In addition to plantings of the imported seed by seed-growers' associations and private producers, several thousand boxes will also be planted on ground belonging to the Department of Lands with a view to accelerating the rate of multiplication as much as possible.

A further matter deserving mention in connection with potato production is the *seed potato inspection service* which has now been in operation for some time. In consequence of the increasing inadequacy of imported seed potatoes from oversea as a result of war conditions, a potato production and research committee was instituted

at the beginning of 1941 in order to take measures for the better protection of supplies of seed potatoes against degeneration diseases under South African conditions, and to safeguard the country's seed-potato requirements in a more effective manner. In addition to a research programme designed to determine among other things, the most suitable seed-potato areas in the Union, an expansion of the Department's inspection service was effected (*a*) by increasing the

A good stand of Tobacco.

production of existing seed-potato growers' associations and by encouraging as far as possible the establishment of new associations in the most suitable parts of the country; and (*b*) by placing the inspection service at the disposal of individual growers who are not members of associations.

Under this scheme 18 new associations were established in different parts of the country, thereby bringing the total up to 21. As a result of the increase in the number of associations a supply of 58,000 bags of certified seed potatoes was made available to farmers

in 1942, as compared with only 3,000 to 5,000 bags before 1921. An additional supply of 60,000 bags of "Government Inspected" seed potatoes also became available pursuant upon the inspections carried out on the farms of individual farmers. During the past year, the departmental inspection service was therefore responsible for making available approximately 120,000 bags of seed potatoes, which is equivalent to roughly 20 per cent. of the country's total seed-potato requirements.

There is an increasing demand for *soybeans*, which offer great possibilities as an oil-bearing crop and as a source of protein concentrates. Adequate quantities of soybean seed were made available by utilizing the facilities of the Delmas Mills, P.O. Delmas, for this purpose. Apart from the value of its seed, the soybean yields an excellent hay crop and in suitable areas its cultivation cannot be too strongly recommended.

In order to supplement the shortage of *teff seed*, teff growers were asked to thresh as much seed as possible. The possibilities of importation were also explored but, except in the case of Abyssinia, with which negotiations are being conducted at present, no seed could be obtained.

A survey was made of the *seed supplies of other crops*, the seeds of which are for the greater part generally imported, and steps were taken to supplement any shortage as far as possible by importation or by local multiplication. The greatest difficulty is being experienced in the case of the seeds of certain grasses and brassicaceous fodder crops, but it is hoped that considerable quantities will still be brought into the country. In an effort to relieve the position still further, experiments in connection with the production of grass seeds were laid down by the Division of Soil and Veld Conservation, while the Stellenbosch-Elsenburg College of Agriculture and the Cedara College of Agriculture are carrying out similar experiments with the brassicaceous fodder crops.

As regards *vegetable seeds*, the position is reasonably satisfactory and the dependence on importation has been largely removed by greater concentration on local production. At any rate, there is no reason why adequate quantities of almost every kind of vegetable seed cannot be produced locally. This fact was realized at an early stage and special efforts have consequently been proceeding for some considerable time now to encourage the production of good vegetable seed within the Union. By co-operation between the Division of Horticulture, on the one hand, and the seed trade and seed breeders on the other, it was possible to increase the production of seed of staple vegetable varieties to such an extent that the Union is to-day not only able to satisfy its own requirements, but it can even export the seed of certain vegetables, such as onions, cabbage, cauliflower, peas and beans. Every effort is being made to place this new industry of seed production on a sound footing by furnishing seed merchants as well as breeders with the necessary advice and by undertaking the inspection of the crops in the field. The main object is the production of standardized varieties. It is expected that within a relatively short time the Union will be independent of importation as regards the seed of the principal kinds of vegetables. The policy in connection with vegetable production is therefore definitely directed at self-sufficiency.

Stock Feed.

The stock-feed problem is one of the most important matters to which the Food Controller has had to give his attention. A Feeds

Committee was appointed at the beginning of April in order to investigate matters relating to feed supplies and their most effective utilization and, where necessary, to endeavour to bring about improvements. The investigation revealed that existing supplies of protein-rich concentrates, *lucerne hay and teff hay*, are insufficient to meet the country's requirements and that there is a threatening shortage. The fixation of a maximum price for lucerne hay and teff hay considerably alleviated the position, however, and fresh supplies of the former came on the market again.

In view of the great importance of adequate supplies of *bone-meal* for the livestock industry, arrangements were made with the anti-waste organization to collect bones and to prevent the wastage of bones. The bone-meal position remains serious, however, and a further scheme which aims at the intensive collection of bones is now being considered. It is hoped that it will be possible to put this scheme into operation shortly at certain places. Efforts are also being made to place arsenic-free superphosphate at the disposal of farmers in areas where the water is suitable for administering phosphorus to stock through the medium of superphosphate.

In so far as *protein-rich concentrates* are concerned, the position is unfavourable because of the Union's dependence on importation. Only about one quarter of our requirements are obtainable in the Union and from the neighbouring territories. The Feeds Committee, therefore, did everything in its power to promote importation, and an organization which can undertake the large-scale importation of protein-rich concentrates will shortly start operations.

Another task tackled and carried through by the Committee was the *registration of all feeds and feed mixtures* offered for sale by merchants and the determination of standards to which such feed mixtures must conform before they can be placed on the market. The compulsory registration of stock feeds is a step in the right direction and a guarantee to the farmer that he will not obtain full value for the money spent on registered feed.

Petrol and Tyres.

Steps were taken to ensure that in the interests of production, farmers would, as far as possible, be provided with the necessary rubber tyres for tractors. In regard to petrol, negotiations have now been completed to ensure that farmers will, as far as circumstances permit, be able to obtain the necessary petrol on more or less the same system as in the case of rubber tyres for tractors with a view to continuing their production activities.

It is necessary to emphasise in this connection, however, that, wherever possible, farmers should make greater use of draught animals. Such a step is not only demanded by the present shortage of petrol and tyres, but is absolutely essential as a general farming practice in order to promote the conservation and restoration of soil fertility.

Labour.

It is a well-known fact that one of the principal difficulties of farmers in many parts of the country to-day is the shortage of European, coloured and native labour. It is a problem which undoubtedly has a retarding effect on production. An Inter-departmental Farm Labour Committee, of the Departments of Agriculture, Defence, Native Affairs, and Justice has therefore been appointed to investigate and report upon the following matters:—

(*a*) The exemption of certain members of the farming community from military service;

(*b*) the employment of prisoners of war;
(*c*) the recruitment of coloureds and natives for military purposes;
(*d*) the recruitment of natives by farmers and other organizations, such as the mines, the Railway and Road Administrations, etc;
(*e*) a better distribution of redundant coloureds and natives in rural and urban areas and its implications in the light of laws and regulations governing urban housing; and
(*f*) private employment of natives by municipalities and other employers in urban areas.

Considerable progress has already been made with the investigation and it is confidently expected that the committee will put forward recommendations which will greatly ameliorate the position. As has been announced, Italian prisoners of war are already being placed at the disposal of farmers.

Import and Export.

In order to supplement the various measures being taken to safeguard the food-supply position, it is also essential, within the limits of the shipping space available, to import supplies of those foodstuffs and farming requisites which are not produced or manufactured in the country at all, or at any rate to an inadequate extent only. So, for example, all possible assistance is being rendered to importers to obtain shipping space and with the granting of preference for the importation of supplies of articles such as groundnuts, rice, coffee, grain and wool bags, farm machinery, spare parts, fertilizer, seed and essential farming requisites, like binder twine, baling wire, etc., while tea is being purchased directly by the Food Controller. More information will be given later on the steps being taken in connection with the importation of some of these requisites.

The demand by convoys and other ships touching at Union ports for food requirements, such as flour, condensed milk, tinned meat and fish, is exceptionally heavy, and in this connection special measures are being taken to get supplies imported for the provisioning of ships with the specific object of conserving the limited local stocks. In addition, control is being exercised at the ports over the quantities of foodstuffs which may be supplied to ships.

Control over the export of food supplies is of still greater importance, especially when it is borne in mind that countries which obtained their requirements from America, the East and Europe before the war, now look to the Union for supplies. The supply of foodstocks to such countries, including neighbouring territories, cannot be stopped completely since this may, in the first place, evoke the application of similar counter-measures in respect of the Union's requirements from those countries or territories and, in the second place, it is desirable that trade relations should be built up with a view to post-war markets. With due allowance for these factors, strict control is nevertheless exercised over the export of foodstuffs and, when local circumstances demand it, no export is allowed even to adjacent territories, as is the case, for instance, with wheat and maize. In the case of certain products, such as potatoes, onions and fish, arrangements have been made with neighbouring states only to import fixed quantities from the Union according to seasonal supplies. As regards other foodstuffs and farming requisites, export is allowed only to a limited extent when local supplies warrant such a course,

Canning and Dehydration of Certain Food Products.

It is obvious that measures for the increase of food supplies must take into consideration every possible channel of expansion, and they cannot halt at direct increase of production and importation. There is also, for example, the important field of food preservation, and in his endeavour to increase and conserve stocks of food for the country, the Food Controller is also devoting earnest attention to this aspect of the general problem.

Refrigeration, canning and dehydration are, in point of fact, among the most important methods which can be applied for the preservation of perishable products for use in times of scarcity, and particular attention is therefore being given to these matters by a special section of the Food Control Organization. A survey has been made of all cold storage facilities with a view to their most effective utilization in the national interest. As a result of the increasing scarcity of meat, an investigation is also being conducted into the possibility of supplying larger quantities of fish to the public, and in consequence of the highly perishable nature of this product, refrigeration and other methods of preservation will have to play an important rôle in distribution.

Despite the current difficult position in regard to tinplate stocks, it has hitherto been possible to import sufficient supplies to draw up a comprehensive programme for the canning of fruit, milk, jam and fish. The available supplies of tin plate do not permit of unlimited quantities of vegetables being canned. In this connection, however, a new method, at least in so far as the Union is concerned, is being followed, namely the preservation of vegetables by dehydration. In some oversea countries great progress has already been made in this respect, and in the Union various factories are now being erected under the guidance of the Food Controller. Prospects are very promising and, although production has hitherto been small, considerable progress ought to be made in this direction during the following year. This new industry will also bring about a considerable measure of stability in the marketing of vegetables and at the same time make it easier to obtain vegetables at all times of the year.

Regulation of Marketing and Distribution.

The importance of this part of the activities of the Food Control Organization, which has been entrusted to the Marketing and Distribution Section, is obvious. Increased production alone cannot benefit the nation as a whole unless steps are taken at the same time to ensure that all groups and sections of the community receive their rightful share of that production. Furthermore, if supplies diminish and are insufficient to meet the total demand, equitable distribution becomes all the more necessary because it may then happen even more easily that needs are not satisfied in accordance with the actual importance of the different consumer groups and channels of consumption of the country. Needs must be co-ordinated with supplies and distribution must be so arranged that supplies can be made available according to a system which will best serve the national interests.

While the war economy of most countries has made strict rationing of the principal articles of food absolutely unavoidable, the Union is to-day in a comparatively favourable position in so far as this matter is concerned. Rationing for every person in this country by means of ration coupons, for instance, has fortunately not been necessary hitherto, and we hope that it will never become necessary either. Rationing according to individual requirements would also

be much more difficult here than in most of the countries of Europe, where differences in the needs of the people, their way of life and diet, quite apart from their purchasing power and standard of life., are much smaller than is the case in South Africa. There is also another respect in which we are in a better position than most other countries, and that is that South Africa is, to a very large extent, self-sufficient and, therefore, does not have to contend with all the serious problems confronting countries which are largely dependent on imported foodstuffs for the provisioning of their people.

We are admittedly dependent on imports for certain articles of luxury, as well as for rice, and the Food Controller has undertaken the direct importation of tea, but as far as the other food products are concerned, we have in reality no rationing problem in the true sense of the word. The main thing, however, to which we must give particular attention is the proper marketing and distribution of the products produced in this country in order to ensure a satisfactory apportionment and to prevent speculation with the nation's food. The distribution system must also be so designed as to make for reasonable prices to both the producer and the consumer. Except for the buying up of groundnuts by the Food Controller for the purposes of conserving seed, maize and butter and cheese have so far been the only locally produced products where direct restrictive distribution has had to be applied.

As has already been mentioned, the Food Controller is actively assisted by the respective control boards in his efforts to regulate marketing and distribution. These bodies which are so often the object of criticism have shown that they are really a great national asset under the prevailing circumstances. Each one of them is doing valuable work in his own particular field, and in connection with the supply and distribution of food, reference need merely be made to the following to emphasise their value: the Wheat Control Board has rendered the country a great service by the steps it has taken in regard to the importation of wheat in order to supplement the shortage; the Dairy Control Board has played a very important rôle in connection with the conservation and distribution of butter and cheese supplies during the period of low production and also in connection with the regulation of the prices of dairy products; and the Mealie Control Board and its whole administration is the organization which is being used at present by the Food Controller for the practical execution of the special measures applied in connection with maize.

Tea.

Control over the purchase and distribution of tea originally rested with the Department of Commerce and Industries, but was taken over by the Food Control Organization as from 16 June 1941.

In view of developments in the Far East which resulted in the loss of the tea-export from Java and other tea-producing countries, it was decided at a meeting of tea-importing countries to institute a co-ordinated purchasing scheme with the object of stabilizing prices and ensuring equitable distribution in respect of the tea still available. India, Ceylon, and to a lesser extent, East Africa and Portuguese East Africa are the principal remaining sources of supply.

The Union is participating in this scheme and has agreed to take a quota which is equivalent to approximately 75 per cent. of its present requirements. Supplies are drawn from the countries mentioned.

Purchases are made by the Food Controller from the British Ministry of Food, and distributed among importers on the basis of

75 per cent. of the quantities which they imported during 1941. The distribution by importers to wholesalers and retailers is effected in accordance with the provisions of Government Notice No. 1390 of 17 July 1941, which prohibits the sale of more than 75 per cent. of the average monthly sales during the period 1 September 1941 to 28 February 1942. Retailers are allowed to supply their clients with 75 per cent. of their purchases during the same period and to sell 1 lb. of tea for cash to a customer.

Hitherto this system of rationing has worked extremely well and, as the public itself can testify, very little inconvenience has been caused thereby.

Maize.

Maize is the most important product falling within the province of the Director of Distribution and Marketing, and the principal facts in connection with the latest development in this great industry are therefore briefly indicated here.

The 1940/41 *Maize Crop*: The 1940/41 maize crop was finally estimated at 24,324,000 bags. Owing to the great increase in the local consumption, there was no carry-over from the previous season.

In regard to prices, it should be mentioned that with the financial assistance of the Government, the Mealie Industry Control Board was enabled to stabilize to producers prices in the neighbourhood of 8s. 6d. per bag, ex elevator, for grade 2 mealies, at the beginning of the selling season, i.e., from 1 May 1941. In addition, the Board decided once again to make a supplementary payment of 1s. 6d. per bag on the first 500 bags sold by each producer. The large majority of maize producers were thereby assured of a price of 10s. per bag. As during the previous year, the Board again purchased elevator maize later in the season, in order to keep up the price to producers. For this maize the Board paid 8s. 6d. per bag for grades 2 and 6, and 8s. 3d. per bag for grades 3, 4 and 5.

A levy of 2s. per bag was also imposed on all maize or maize products bought from producers after 1 May, while an export bounty of 2s. 9d. per bag was paid from the same date. In consequence, the consumer's price was also raised, namely, to 10s. 6d. per bag, ex elevators, for wholesale quantities, a smaller increase being made later in the year with a view to covering interest and storage costs. The Board further decided again to grant a rebate of 1s. 6d. per bag on maize and maize products to registered stock feeders.

Later in the season it transpired that the local consumption of maize was steadily increasing, the effects of the factors which eventually necessitated a mild form of rationing thus manifesting themselves at an early stage. The principal factor in this connection was the drought which then prevailed and which not only considerably accentuated the demand for maize for stock feeding purposes but also greatly weakened the prospect of a reasonable crop during 1942. Prices, especially those of white mealies, rose steadily while supplies became increasingly scarce. As a result of this relative scarcity and the necessity of conserving stocks as much as possible in view of the expected smallness of the crop, the Mealie Industry Control Board, in consultation with the Department, took steps from time to time in an effort to cope with the situation. The measures embraced:—

(*a*) a prohibition on the exportation of all maize and maize products;

(*b*) the discontinuation of the payment of the stock-feeders' rebate of 1s. 6d. per bag in respect of all white maize;

(*c*) the fixation of maximum consumers' prices for maize and maize products; and

(*d*) the arrangement that mealie meal and other maize products should no longer be manufactured from white maize only but from either yellow maize alone or from yellow maize and white maize mixed.

These measures undoubtedly contributed in no small measure towards relieving the position, but did not prove adequate. In particular were they incapable of solving the problem of disproportionate distribution. The Government was therefore compelled to extend the powers of the Maize Control Board and under the powers vested in it by War Measure No. 20 of 1942, the Board proceeded:—

(*a*) to take over all surplus supplies from traders and millers at fixed prices;

(*b*) to prohibit producers from selling to any person other than the Board, also at fixed prices, and

(*c*) to cancel the stock-feeders' rebate on yellow maize and yellow maize products as well.

These measures remained in force until the end of April, 1942, after which the scheme came into operation for the new crop.

Disposal of the 1941/42 *Maize Crop*: The fears that the 1941/42 maize crop would be considerably below normal as a result of the drought were, unfortunately, only too well founded.

In the circumstances the Food Controller deemed it necessary to control the disposal of the whole crop from 1 May 1942, in order to ensure that the available supplies would be put to essential national uses. To this end a permit system was put into operation. Under this system ordinary consumers are required to possess a permit for the purchase of their requirements in excess of 2 bags per month and bona fide farmers for the purchase of their requirements in excess of 25 bags during June, 10 bags during July to the end of September, and 5 bags per month after 1 October. Maize is allotted to millers and traders on the basis of their turnover during last year.

Price fixation is an essential requirement for the proper application of this system of regulated distribution, and prices were therefore fixed to both the consumer and the producer. The level at which these prices were fixed cannot but be regarded as reasonable for all concerned. A price of 15s. per bag for the best grades is quite remunerative, even if the smallness of the crop and the increased production costs are taken into consideration. Similarly, the sender's prices of less than 17s. per bag for consumers is very reasonable, especially if regard is had to the fact that the demand for maize is considerably greater than the supply. There is, therefore, no legitimate reason for the producer or the consumer to complain about the prices which have been fixed for maize and maize products.

The following are the prices fixed to producers at the place of delivery according to agreement:—

For grades 2, 4 and 6: 15s. per 200 lb. in bags.

For grades 3, 5 and 7: 14s. 10d. per 200 lb. in bags.

For grade 8: 14s. 8d. per 200 lb. in bags.

For maize in elevators the producer's price is 9d. lower per 200 lb. in each case.

Consumer's prices per bag (f.o.r. sender's station) are as follows up to 31 August 1942:

	Nos. 2, 4 and 6.	Nos. 3, 5 and 7.	No. 8.
	s. d.	s. d.	s. d.
100 bags or more	15 7	15 5	15 3
99 to 21 bags	15 10	15 8	15 6
20 to 6 bags	16 1	15 11	15 9
5 to 2 bags	16 4	16 2	16 0
1 bag	16 7	16 5	16 3

After 31 August 1942, all the above consumer's prices are increased by 1d. per bag per month.

In the case of maize products, the following maximum prices per bag (f.o.r. buyer's station) were fixed:—

Maize Product.	30 Bags and more.	29 to 11 Bags.	10 to 6 Bags.	5 to 2 Bags.	1 Bag.
	s. d.	s. d.	s. d.	s. d.	s. d.
No. 1 fine granulated mealie-meal	18 0	18 4	18 8	19 0	19 6
Unsifted granulated mealie meal	17 6	17 10	18 2	18 6	19 0
Unsifted other than granulated mealie meal	17 0	17 4	17 8	18 0	18 6
Sifted crushed mealies	17 3	17 7	17 11	18 3	18 9
Unsifted crushed mealies	17 0	17 4	17 8	18 0	18 6
Samp	23 6	23 10	24 2	24 6	25 0
Mealie-rice	23 6	23 10	24 2	24 6	25 0
Maize germ meal	11 6	11 10	12 2	12 6	13 0
Hominy chop	10 0	10 4	10 8	11 0	11 6

Although restrictions have been imposed on the supply of maize and maize products for certain purposes, every effort is being made to satisfy all requirements for human consumption. In addition, maize is being made available for the production of essential protective foods such as fresh milk, dairy products, eggs and bacon. To this end allocations are made on a carefully worked out basis which aims at the most profitable utilization of maize as stock feed in balanced rations.

In order to excercise more effective control over existing stocks and to find a solution to certain difficulties in connection with the supply of maize, the Mealie Industry Control Board decided, in terms of War Measure No. 20 of 1942 and in consultation with the Food Controller, to take over at fixed prices all maize stocks held by co-operative societies. The Board further decided to appoint Unie-Graan as its selling agent. Orders for maize can therefore now also be placed with this company.

In regard to seed maize which is an important factor for a good crop during the coming season, a producer of maize is allowed, under Government Notices Nos. 1835 and 1837 of 11 September 1942, to sell seed maize to another producer at a minimum price of 17s. 6d. per bag. The seller must obtain a permit from the Mealie Industry Control Board and the purchaser of seed maize similarly requires a permit from the Board for the purchase of more than 10 bags during September or of more than 5 bags after 1 October.

In order to encourage the production of maize during the coming season, the Government has decided to make arrangements with the

registration of bakers and other persons processing wheaten products. The Board was thus given full control over the baking industry and was enabled to begin with the rationalization of that industry. As a first step, the Board imposed restrictions on the establishment of new bakeries since there are already far too many bakeries in practically every large centre. In this way the Board seeks to prevent an aggravation of the existing position and at the same time to make a start with the strengthening of the foundations of the baking industry.

Dairy Products.

So adverse was the effect of the drought on the production of dairy products and so pronounced was the increase in consumption that a mild form of rationing was necessitated in respect of butter and cheese during the last few months of 1941. This rationing was gradually relaxed as conditions improved, but it was not until January 1942, that production overtook consumption and that rationing could be discontinued. The difficulties were accentuated by the fact that during a considerable part of the year dairy farmers had to contend with the problem of a feed shortage. Indeed, had it not been for the fact that during the previous season the Dairy Industry Control Board had built up large reserve stocks of butter which could be distributed during the period of drought, we would undoubtedly have been faced with a much more serious position.

For the twelve months ended 31 August 1942, the quantity of creamery butter produced in the Union amounted to 39,791,673 lb. which was more than 5½ million lb. short of the production for the previous twelve months, and emphasizes the hampering effect exercised by the drought on dairy production. In South West Africa, Bechuanaland and Swaziland also, butter production was below normal. On the other hand, the production of cheese was well maintained, the total quantity amounting to more than 15,000,000 lb., which figure exceeds the quantity for the previous year by almost 1½ million lb. This is apparently attributable, on the one hand, to the fact that cheese-producing areas were not so seriously affected by the drought and, on the other, probably to the fact that cheese-milk prices were more attractive to farmers than butterfat prices.

The increase in consumption occurred in all the channels of absorption, namely, sales within the Union, the provisioning of convoys and ships, and export to neighbouring territories. Except for consignments to certain parts along the African coast, no butter or cheese was exported oversea. The total consumption of butter amounted to approximately 50,000,000 lb., which is roughly 3,800,000 lb. more than that of the previous year. In the case of cheese, the consumption was approximately 14,700,000 lb., which also represents an increase on the figure for the previous year. There is no doubt that the consumption of both butter and cheese would have been much greater still if larger supplies had been available.

Quite early in the year it was realised that consumption would exceed production and that if production was to be maintained at the highest possible level during the winter months, a timely indication of prices had to be given in order to encourage producers to make every possible provision for winter feed. The Dairy Industry Control Board consequently raised the prices of butterfat delivered to creameries to 1s. 5d., 1s. 3d. and 1s. 1d. for first, second and third grade, respectively, as from 1 February 1942, and intimated at the same time that it intended to pay a winter sudsidy of 3d. per lb. on all grades of butterfat from 1 May, and an additional 2d. per lb.

from 1 July, as a result of which the total subsidy would be brought up to 5d. per lb. and the price to the producer up to 1s. 10d., 1s. 8d. and 1s. 6d. per lb. for first, second and third grade butterfat, respectively. As from 1 February 1942, the price of cheese milk was also raised to 8½d. per gallon and to 1s. 11½d. per lb. butterfat in cases where the milk is sold on a butterfat-basis. The Board also announced that a subsidy of 1½d. per gallon or 4½d. per lb. butterfat would be paid from 1 May, thereby bringing the price to the producer up to 10d. per gallon or 2s. 4d. per lb. butterfat. This policy had the desired effect of stimulating production, since, in spite of the low summer output as a result of drought, production reached a record during the winter. In the case of both butter and cheese, approximately two million lb. more were produced during the months April to August than during the corresponding period of 1941.

The subsidies paid to producers of butterfat and cheese milk are met out of funds obtained from the industry itself by means of a special levy imposed on manufacturers of creamery butter and cheese. In view of the undesirability of wide fluctuations in the prices of butter and cheese, and at the same time of the necessity of paying a higher winter price in order to compensate the producer for his increased costs during this period of the year and so encourage him to maintain production, the Board laid down a policy for the determination of the relationship between the price of butterfat and butter and the price of cheese milk and cheese. In determining this relationship, due consideration is also given to the price required to cover the manufacturing and distribution costs, and to allow for a reasonable profit over the whole year on the capital invested. It was possible in this manner to maintain butter and cheese prices throughout the winter at the level fixed on 1 February.

Since it was necessary first to institute an investigation into the manufacturing costs of condensed milk and milk powder, it was not possible for the Dairy Industry Control Board to fix the prices of milk used for the manufacture of these products. At the request of the Minister, however, the large majority of manufacturers paid producers a price for condensing milk which ranged from 9d. per gallon in the summer to 11d. per gallon in the winter. The investigation has now been completed and it is expected that in the near future the Board will fix prices for condensing milk along the same lines as for butterfat and cheese milk. Manufacturers of condensed milk and milk powder have already been registered under the Dairy Products Marketing Scheme.

In so far as fresh milk is concerned, a control scheme has not been brought into operation again since the scheme introduced by the Dairy Board was declared invalid by the Court last year. Careful investigation has been instituted into the possibility of introducing a satisfactory scheme under the Marketing Act, but this does not seem to be practicable. At present the possibility is being considered of putting a scheme into operation under the Emergency Regulations, but even this appears to present considerable difficulties.

As regards the question of fresh-milk prices, there has also been no official price fixation up to the present. In consultation with the Food Controller, however, the Price Controller has indicated maximum prices for the urban centres such as the Rand, Cape Town, Durban, Pretoria, Port Elizabeth, East London, Bloemfontein, Pietermaritzburg and Kimberley. The understanding is that as long as producers and distributors do not go beyond the prices indicated, the Price Controller will not institute official maximum prices.

In view of the increased production costs, however, and particularly the scarcity of feed, reasonable increases have been allowed to producers under this system.

During the past year, therefore, dairy farmers obtained better prices for their products than was the case during the previous year—prices which are calculated to meet the increased production costs in the industry, and to maintain at the highest possible level the production of these vitally important protective foods. Consumers, on the other hand, certainly did not pay too much for these products, especially if regard is had to conditions which prevailed. Throughout the winter, first, second and third grade butter, for example, were sold at 1s. 10d., 1s. 8d. and 1s. 6d. per lb. respectively, and first, second and third grade cheese at 1s. 6d., 1s. 5d. and 1s. 3d. per lb., respectively. These prices are not too high; on the contrary, they testify to the great benefits which control over the dairy industry has already conferred on consumers.

The Purchase and Sale of Food Products.

It has already been pointed out that in the case of livestock and the more perishable products like vegetables, fruit and eggs, a policy of price fixation is impracticable and that the Food Control Organization was compelled to follow another method of influencing prices—a method which has as its principal object the elimination, or at least the limitation, of the wide price fluctuations which take place from time to time with detrimental and discouraging effects on the producer. At the same time the method is naturally designed to further the interests of the masses of less well-to-do consumers. In other words, price stabilization, is the great object aimed at. In order to tackle systematically this aspect of the problem, the purchasing and selling method is employed and to that end the Purchasing Section was established.

It should be pointed out here that the personnel of the section have been withdrawn mainly from the Marketing Section of the Division of Economics and Markets and that these officers have wide experience of conditions on the various central markets. They therefore possess the necessary experience to carry out this important work satisfactorily.

In order to give effect to the fundamental object envisaged by the establishment of the Purchasing Section, it has been charged with two main functions:—

(*a*) To operate on central and other markets so that by its purchases the market price for the producer can be stabilized on a reasonable and remunerative level; and

(*b*) to supply military camps, convoys and neighbouring territories with certain food requirements.. Obviously, these functions are complementary. It is essential that the Section should have an outlet for its purchases, and that outlet has been obtained through the new channels of demand created by the prevailing abnormal conditions. Indeed, this new market itself is one of the principal reasons for the establishment of the Section. Furthermore, the wider this market, the greater can be the range of the purchases made and the more effective the influence which the Section exercises in respect of price stabilization. Military camps and convoys do not fall within the scope of normal trade so that use can be made of these channels as a convenient outlet for purchases without entering into the field of ordinary trade.

In so far as *military camps* are concerned, the position is that initially, i.e., from 1 April 1942, the seven large military camps were supplied with beef and mutton. Onions were delivered to all the camps, and potatoes to six camps. From 1 July, meat was supplied to a further five camps. As from 1 October, potatoes and onions will be supplied to all camps and meat to another large camp.

As regards *convoys*, it was decided in May, after discussions with the trade, to leave the delivery of meat to the trade for the time being. In the light of experience hitherto gained in connection with this matter, however, it is felt that it is desirable that the Purchasing Section should also take over this service. From the middle of August the Section has had the sole rights to provide convoys with potatoes and onions. At the moment delivery to convoys is still indirectly carried out through caterers who are compelled, however, to place their orders for products with the Purchasing Section.

Owing to the difficulties connected with the issue of export permits to individual exporters, arrangements have been made with the governments of neighbouring territories to place orders for their requirements in respect of potatoes and onions directly with the Food Controller. The Purchasing Section buys the required quantities and can in this way exercise complete control. Obviously, this is in the interests not only of the territories on whose behalf the purchases are made, but also of the Union, since supplies must be husbanded as far as possible.

In regard to purchases, it should be mentioned that *potatoes and onions* are bought mostly from producer organizations or direct from farmers. Nevertheless, buyers attached to the Section continued to keep an eye on the central markets, and on occasion considerable quantities have been purchased on the markets themselves with a view to maintaining a reasonable price level and to preventing unhealthy fluctuations. In the case of *cattle and sheep*, purchases are made as follows:—

(*a*) on the central markets: Johannesburg and Cape Town, while beef and mutton are purchased in Durban;

(*b*) at country auctions: in Natal, the Orange Free State and the Transvaal; and

(*c*) direct from producers.

In the case of purchases of cattle and sheep on the central markets, the animals are immediately slaughtered at the various centres. Where purchases are made at country auctions or direct from producers, the cattle are either railed direct to one or other centre and slaughtered there, or dispatched to the Pongola and Vaal-Hartz Settlements where they are kept in reserve on good grazing for later use. Over and above some 3,000 head of cattle which have been put on grazing, the Section placed approximately 2,750 carcases in reserve in cold storage during the season of plenty (May and June), for use during the period of scarcity (September-November).

The importance of these reserves lies in the fact that the cattle are bought at a time, i.e., just before the winter, when farmers are compelled to sell their stocks owing to a shortage of grazing and feed. Under the reserve system, the good grazing on the settlements which could otherwise go to waste, is put to excellent use, not only for maintaining the animals in condition, but also for getting them to put on weight. In addition, this systematic utilization of the reserves during the period of scarcity enables the shortage on the market to be supplemented, and will act to a certain extent as a check on the already exceptionally high prices of meat. The reserves are there-

fore an important factor towards the realization of the price stabilization policy and benefit both the Department of Defence and the civilian consumer.

The activities of the Purchasing Section have undoubtedly saved the Department of Defence many thousands of pounds and ensured that it obtained products of better quality than ever before. For the producer, a remunerative price level has been maintained, while the consumer has been protected in so far that supplies have been more evenly spread over the different seasons. Indeed, the whole organization worked very smoothly throughout and fully proved its value.

Since the economic development in the case of perishable products, like meat, eggs and potatoes, was closely bound up with the activities of the Purchasing Section during the year, it is deemed appropriate at this stage to record a few facts about the general position of these products.

Meat.

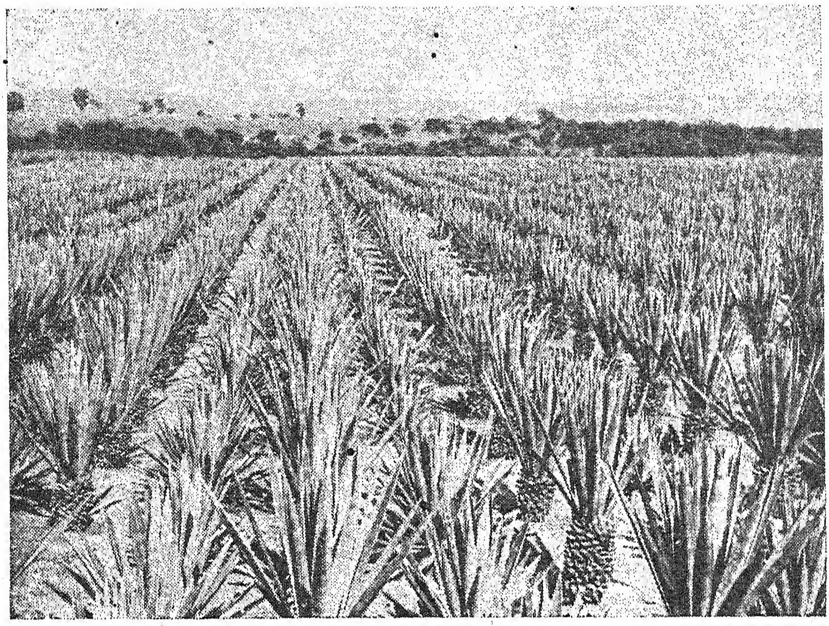
With the exception of maize, there is no other product which gave the Department and the Food Controller so much cause for anxiety during the year as meat. The Union has never produced any considerable surplus of slaughter stock, this being due to the periodical unfavourable natural conditions which from time to time claim as their victims substantial numbers of stock and naturally hamper the increase of our herds and flocks. There is the further fact that South Africans as a nation are exceptionally large meat-eaters—in many cases eating more than is good for their health—so that meat occupies a very important place in the diet of the family, especially on the farms. Add to this the fact that meat is the staple food of the army, and we have the principal factors underlying the present meat problem.

From the production point of view, the past two years were far from favorable for the slaughter-stock industry. Most of the slaughter-stock-producing areas suffered severely from drought, which not only caused serious losses in stock and interfered with breeding, but also resulted in the available stock being in an unmarketable conditions for certain periods.

These restrictions on production were accompanied by an immense increase in the consumption of meat. Even before the war there was a perceptible increase in the consumption of meat in the Union, and it will be readily understood that the war greatly accelerated the rate of consumption. Since the outbreak of the war, the slaughtering at municipal markets alone, and the figures naturally do not include all animals slaughtered, increased by approximately 150,000 head of cattle and 860,000 head of small stock. The following figures indicate the slaughtering at municipal markets for the past four years and emphasize the fact that the consumption increased by leaps and bounds every year.

	Slaughter Cattle.	Slaughter Sheep, Goats and Lambs.
1938-39	639,600	3,419,000
1939-40	684,500	3,756,000
1940-41	764,900	4,185,000
1941-42	832,600	4,618,000

Encouraged by the exceptionally high prices paid for slaughter stock slaughter-stock farmers did everything possible on their part to meet the increased demand. At the same time, the Department and



Sisal in the Barberton district.

the Meat Board also did their best to relieve the position. In addition to the regulation of the supply of cattle and sheep over the different days of the week to the markets at Johannesburg, Cape Town and Pretoria in order to ensure uniform distribution, the Board also granted all permits in respect of applications from areas in the Union. The Department on its part also made special efforts, particularly in regard to the drawing of larger supplies from certain neighbouring territories. Cattle from South-West Africa already have free access to Union markets. In the case of the Bechuanaland Protectorate, the weight restriction on cattle to the controlled markets was lifted, and later the same was done in respect of Swaziland cattle to the Durban markets. In addition, the maximum quotas to these markets were first considerably increased and later suspended altogether, so that cattle from those areas now have free access to all the controlled markets of the Union, and cattle from Swaziland to the Durban market. In spite of these measures, however, we still run a real risk of reducing the numbers of our breeding stock to a dangerously low level owing to the continued demands being made on the Union's slaughter-stock industry.

It stands to reason that as meat was the only important agricultural product which remained uncontrolled, the prices of slaughter-stock and meat should reach an exceptionally high level under this condition of disproportionate relationship between supply and demand. Actually, farmers received unprecedentedly high prices for slaughter stock and, generally speaking, consumers had to pay very high prices for meat. Indeed, the Food Controller and the Price Controller again had to devote their serious attention to the whole problem of stock and meat prices during the last few months.

As has been indicated, the Purchasing Section has already done very valuable work in connection with the stabilization of the meat

position in the interests of both producers and consumers, and had it not been for its important contribution, the present meat position would certainly have been much more difficult. We stand on the eve, however, of the months of a normal seasonal reduction in the supplies of slaughter stock, and we must therefore not only expect, but the trend of circumstances already clearly indicates, that the prices of slaughter stock will go still higher in the very near future.

This will mean that the prices of slaughter stock will assume an unsound relationship towards those of other agricultural products, and that the government will shortly be compelled through sheer necessity to resort to the fixation of meat prices. It should be pointed out in this connection that in view of the need for drawing the largest possible number of slaughter stock and the numerous difficulties attending the fixation of prices, especially from the point of view of grading which is essential for the protection of the consumer under a system of price fixation, the Government has hitherto hestiated to take such a step. The stage has been reached, however, where action has become imperative, mainly also in the interests of the economic stability of the country in general and of the farming community in particular. The inflationary trend of meat prices is beginning to have an undesirable effect on agriculture, a fact which is already being realized by many producers.

It has therefore been decided to fix maximum prices for the different grades of beef and mutton at an early date. In view of the necessity of grading, it will probably be possible to fix prices only on the principal markets at first, but since these markets have a predominating effect on the prices of slaughter stock and meat, it may be expected that in other parts of the country the prices will follow the trend of the prices fixed. For various reasons and particularly because our stock-marketing system does not lend itself to such a course, it is impracticable to fix the prices of slaughter stock as such. Fixed meat prices ought, however, to have a stabilizing influence on the prices of slaughter stock, and the Purchasing Section will in any case actively continue with its purchasing and selling operations, thus making further for stability in prices.

In so far as consumers are concerned, they should realize by now that the country's meat requirements are exceptionally high in relation to the available supplies, and that they are facing a period of increased meat prices, despite the imminence of price fixation. It is therefore not only in the national interest, but in their own as well that they should be as economical as possible in the use of meat and that they should do everything in their power to avoid waste.

Eggs.

This is another product the local consumption of which has greatly increased during the past two years. The difficulties of production, on the other hand, were also increased considerably, first by the introduction of the standard loaf, which caused the disappearance from the market of bran and pollard as poultry feed, and later by the scarcity of maize for feeding purposes.

For the sale of the export surplus of the 1941 season, a contract was once again entered into with the British Ministry of Food on lines of one which applied for the 1940 season. Moreover, efforts to increase the contract prices were met with success, the new prices being approximately 1s. 6d. per 10 dozen or 4s. 6d. per box (30 dozen) better for all classes and grades as compared with those for the

previous season. Prices on the local market were also quite good, so that, on the whole, poultry farmers derived a reasonable income from their undertakings.

This season (1942) there has been a decline in production, while the local consumption continues to be high. To what extent eggs will be available for export is difficult to predict, but there is little likelihood in any case of export taking place during the present season.

In order to stabilize prices and to assure a reasonable price to the producer, the Food Controller has therefore decided to purchase at fixed prices any surplus eggs which producers and producer organizations cannot dispose of through the ordinary channels of trade. Such eggs, however, must be tested, packed in standard export boxes, and conform to the export specifications for eggs of first quality. For large eggs (24 ozs. per dozen) the price fixed is 1s. 5d. per dozen, and for eggs of medium size (21 ozs per dozen) 1s. 3d. per dozen. In addition, an allowance not exceeding 2d. per dozen is paid for packing costs. These prices are paid for unlimited quantities of eggs in Johannesburg, Durban, Cape Town, and for limited quantities in Pretoria, Bloemfontein, Port Elizabeth and Pietermaritzburg.

Potatoes.

Potatoes play an extremely important rôle under the present circumstances in so far as our food products are concerned, and there is no doubt that the potato industry has come into great prominence since the outbreak of the war. In fact it is one of those industries which have been characterized by considerable development as a result of war conditions.

As regards production, the total potato yield of the Union has shown a declining tendency during the three years of war. The reason for this has not been due to lack of encouragement as a result of any decrease in consumption, but to other factors, such as, for example, the scarcity of fertilizer, drought conditions and poor seed. The war has greatly interfered with the regular importation of adequate quantities of seed potatoes. The following figures indicate the production for the past four years:—

1938/39: 2,892,541 bags. 1941/42: 2,355,365 bags.
1939/40: 2,265,666 bags. 1940/41: 2,521,544 bags.

Compared with that of 1938, the consumption of potatoes during the past year showed considerable increase for the reasons already advanced for the increase in the case of the consumption of other food products. Although the position in respect of the increases in consumption is not accurately reflected in the sales figures on the large markets, these figures, nevertheless, give an indication of the upward trend which is further emphasized by the figures for ships' stores, as will appear from the following table:—

	1938.	1939.	1940.	1941.
Purchases on larger markets (in bags)....	1,107,090	1,235,835	1,242,634	1,289,435
Purchases for ships stores (in bags)......	9,649	9,736	32,616	135,966

The consumption for 1942 is expected to be much greater still.

As a result of the decline in the supply and the concomitant increase in the demand, prices rose to high levels, and, after consultation with this Department, the Price Controller fixed the maximum price of potatoes at 25s. per bag in November 1941. Although there

were periods when prices evinced a declining tendency, potato growers received a reasonable price, on the whole, for their product. Index figures (basis 1936/39 to 1938/39 = 100) fully substantiate this fact. For instance, in comparison with the basis figure, the index figures for August, October and December 1941 were 251·8, 334·8 and 229·8 respectively, and for February, April and June 1942 they were 190·1, 192·2 and 212·1 respectively.

Measures to Obtain Agricultural Requisites.

One of the greatest difficulties presented by the war, for the farming community of South Africa, is the shortage which it has created in regard to all the various implements and requisites needed by the farmer from day to day in order that he might properly carry out his task of production. This is one of the directions in which we have hitherto always had to rely upon importation to a very large extent and in respect of which a considerable amount of dislocation has unavoidably arisen as a result of the lack of shipping facilities. The seriousness of this problem naturally lies in the fact that these requisites are practically indispensable for the maintenance of production at the desired high level and that production must inevitably suffer if they cannot be obtained.

In consequence of the gradual deterioration in the supply position in respect of these important instruments of production, a Controller of Agricultural Machinery, Implements and Requisites was appointed in April 1942, under War Measure No. 7 of 1942, for the purpose of giving advice on the importation and exportation, and exercising control over the distribution, of all agricultural implements and machinery, hessian and cotton containers, binder twine and sewing twine.

The main object and functions of this control organization, which has already assumed considerable dimensions, can be summarized as follows:—

(*a*) To investigate every application for the importation of the above-mentioned goods and to determine their relative necessity in relation to the country's requirements;

(*b*) to assist importers in their dealings with the authorities concerned regarding the execution of orders placed oversea and in the procuring of shipping facilities;

(*c*) to encourage the local manufacture of agricultural requirements where such manufacture is possible at reasonable cost and to assist manufacturers in surmounting their difficulties;

(*d*) to assist persons and firms, which undertake the repair of agricultural implements and machinery, in overcoming their difficulties so that they can extend their activities and undertake more work of repair;

(*e*) to control the distribution of goods of which supplies have already become scarce. This is effected by controlling the distribution between wholesalers and retailers, and has so far been done in the case of all implements and machinery, and also in case of binder twine;

(*f*) to allow sale to users only under a permit issued by the Controller where supplies are very limited. Hitherto this system has been followed in regard to tractors, engines of less than 20 horsepower, windmills and power-driven pumps; and

(*g*) to keep a constant watch over the general supply position and new developments so that timely steps can be taken or advice given to farmers, importers and local manufacturers.

The practical execution of these duties naturally involves a great variety of activities. So, for example, monthly statements on stocks, purchases and sales are obtained (and correlated) from 203 firms which deal in all kinds of agricultural machinery and implements, and from 804 firms which do business in the other controlled requisites. Consideration of the numerous applications for the importation and exportation of implements, etc., and the allocation of shipping space for the purpose of importation, also entail a vast amount of work. The same applies to the issue of permits in the case of articles where distribution is regulated under the permit system. Applications for permits are always dealt with as expeditiously as possible. The figures given below reflect the number of permits hitherto issued and refused :—

	Issued.	Refused.
Tractors	257	33
Engines	453	19
Wind-mill heads	1,057	156
Wind-mill towers	842	140
Pumps	952	31

It may be mentioned here that in urgent cases as, for instance, where a pump breaks down in a drought-stricken area, purchases are also authorized on telegraphic advice, provided satisfactory facts about the case are furnished to the Controller by a third party. Up to the present this concession has worked very well.

In spite of the vigorous efforts made by the Controller of Agricultural Machinery, Implements and Requisites to supplement our stocks of *agricultural machinery and implements* by importation, the supply position cannot, unfortunately, be regarded as reassuring. The cumulative effect of the considerably reduced imports during the past three years has naturally created an undesirable state of affairs particularly because this is accompanied by a scarcity of labour, and consequently, a greater need for labour-saving and other agricultural machinery. The most serious difficulty of all is that the shortage is the most severe in the case of spare parts and accessories. This shortage may have an adverse effect on production and is felt most keenly in the case of tractors, planters, separators and certain types of ploughshares.

The net position is that the total stocks of implements, etc., at present in the country are not sufficient to meet our requirements. Orders were placed oversea some considerable time ago, but the greatest difficulty is being experienced in getting them executed with the necessary speed, and further disappointments in this connection are to be expected. Shipping space and facilities are the limiting factor here, and in view of the importance of these instruments for maintaining production to meet the numerous needs of the country, it will be appreciated that it is extremely difficult to solve this problem. The assurance is given, however, that everything possible is being done to alleviate the position. The authorities are, indeed, fully aware of the extent to which agriculture is dependent on importation in this respect, and whatever it is possible to do in the way of effecting importation under the present difficult circumstances, will certainly be done.

It will readily be understood that this state of affairs has compelled us to concentrate more on the *local manufacture of implements*

and machinery. Up to 1940, the Union's production of these articles was negligible. A few firms made harrows, one manufactured a limited number of cultivators, two produced hammer mills, one wind-mills, several certain types of pumps, while a number of engineering firms turned out cast-iron spare parts in half a dozen of the larger towns. Their combined annual production, however, did not amount to more than 1,000 tons, and that despite the fact that the Union's normal requirements are estimated at approximately 40,000 tons a year.

Not until "South African Farm Implements Manufacturers, Ltd." commenced production at Vereeniging in September 1940, did local manufacture of agricultural machinery reach a scale worth mentioning. At first this factory confined itself to such articles as single-furrow ploughs, flat shares for these ploughs and cultivators and has only lately extended its activities to include the manufacture of more complicated implements. With intensified production, however, this concern already turns out a considerable quantity of implements and spare parts. Since 1941 other firms and engineering works have also extended their activities, while some are preparing to commence production in the near future. Despite this greatly increased local production it is not anticipated that the Union will turn out more than 4,000 tons during 1942. Strenuous efforts towards expansion are still made, however, and the policy is to encourage more particularly the greater production of those articles which can be manufactured at a comparatively reasonable cost so that the industries concerned will be able to withstand competition from oversea after the war.

In view of the diminished imports, also of spare parts, *the repair of farm machinery and implements* is everywhere becoming an undertaking of considerable importance. This is a welcome development and one which is being strongly encouraged. Smithies and even motor repair shops in some of the country towns are being deluged wtih repair work for farmers. The possibilities for further assistance to farmers in this direction are being investigated, while arrangements are also being made in centres with engineering shops to carry out repair work to agricultural machines as expeditiously as possible in cases where such work cannot be undertaken in country towns.

Owing to the importance of *bags* for the Union's agricultural industry and certain other industries as well, the difficulty of obtaining supplies of this commodity from the East also necessitated the application of control measures over their importation and distribution Since local supplies were low and great difficulty was experienced in importing fresh stocks, the provision of adequate numbers of bags for the new maize crop created a very difficult position. However, with the aid of bags obtained from Hulett's sugar refineries, by making use on a much greater scale than ever before of second-hand bags, and with fair shipments which arrived in July, it was eventually just possible to meet the bag requirements of the maize farmers.

Since August considerable quantities of grain, wool, orange, cement and sugar bags, etc., have been reaching this country from Calcutta, and if the rate of importation is maintained for another few months, the prospects will be reasonably good.

In order to save as many bags as possible, it was made compulsory for coal, coke and wood to be emptied out of the bags where these commodities are delivered to consumers. In co-operation with manufacturers a scheme was also instituted for the return of cement and lime bags, while consideration is being given to the introduction

of a similar scheme in respect of bags in which vegetables are sold on the local markets.

The Controller concerned has also devoted special attention to *binder twine*, an article which is of great importance to wheat producers. After control had been assumed over binder twine, and information collected in regard to the supply position, it was found that importation plus local manufacture would be insufficient for the coming wheat crop. Immediate steps were therefore taken to have much larger orders placed by importers and to increase local manufacture, which is normally able to satisfy about half the Union's needs. Considerable success was achieved with the expansion of local production, but as numerous difficulties were experienced in connection with importation and the execution of orders placed oversea, the freezing of all binder twine supplies was resorted to on 25 August. Almost simultaneously the use of binder twine was restricted to the binding of grain sheaves and its sale may now be effected only under a permit issued through the office of the Controller of Agricultural Machinery and Requisites.

It is fortunate that our winter-cereal crops in the different parts of the country do not all ripen simultaneously but in successive months, since this makes it possible for the distribution of binder-twine supplies to be spread over a few months. In this way the needs of the Transvaal could be fully met and it is reasonably safe to assume that this will also be possible in the case of the Western Province. No finality has as yet been reached regarding the position of the Orange Free State and the north-eastern Cape Province, but there too, the prospects are quite good.

It is clear from this brief elucidation of the position that every nerve is being strained to cope with the complex and important problem of obtaining and providing farm machinery and requisites. This work is being actively continued.

Dealing with the Fertilizer Problem.

In view of the fact that fertilizer already plays such an important rôle in the country's crop and fruit industries and having regard to the Union's dependence on importation for its fertilizer requirements, it will be appreciated that the lack of adequate shipping facilities has created a difficult problem in connection with the supply of this article. Consequently, steps were also taken in this case to deal with the difficulties arising out of a shortage of supplies. One of the steps taken was to appoint a Controller of Fertilizer who, in close co-operation with the Food Control Organization, is devoting careful attention to the different aspects of the whole fertilizer problem.

The very first measure instituted to assist the farming community in connection with this matter, was to freeze fertilizer prices. This was done in October 1942, and in this way further increases in the price of this important article were prevented. In itself this measure was of the greatest importance since, owing to the scarcity of supplies, fertilizer prices had by then reached a level which was considerably higher than that which had prevailed before the war, and they would have risen much higher if prices had not been frozen.

The most important concession, however, made by the State to farmers in respect of fertilizer was the *institution of the subsidy scheme* under which a subsidy of £1 per ton was granted on fertilizer. The subsidy is payable on fertilizer purchased by farmers as from 1 January 1942, and in order to place the subsidy in a fixed relationship to fertilizer prices and to keep such prices at a reasonable level for

producers, fertilizer prices were at the same time fixed at the level at which they were frozen in October 1941. The subsidy can also be paid in cases where farmers purchased fertilizer during the period September to December 1941, for use in connection with the sowing of winter cereals in 1942. In the case of fertilizer purchased by farmers before 1 June 1942, the subsidy is paid direct to them upon submission of satisfactory documentary evidence. The Department has, however, obtained the willing co-operation of the Fertilizers Traders' Association in this matter, thereby considerably facilitating the application of the scheme. The Association has agreed to deduct the subsidy of £1 per ton direct from the accounts of farmers and then to collect the amounts due to them from the Department by way of weekly claims. This system has been in operation since 1 June and has greatly simplified the work created by the introduction of the scheme. The importance of the fertilizer subsidy scheme is evidenced by the fact that Parliament voted a sum of £250,000 for that purpose for the current financial year.

During the year particular attention was also devoted to the difficult problem of *obtaining fertilizer supplies*. The Union's normal pre-war consumption of all kinds of fertilizer is estimated at approximately 360,000 tons, of which 275 to 300,000 tons were superphosphate. As a result of the occupation of Holland, that country was lost as a source of superphosphate and phosphate mixtures. This meant a considerable reduction in the quantity of fertilizer available to the Union every year. Later, the importation of Moroccan rock phosphate also became impossible, in consequence of which production by the local superphosphate factories was greatly retarded. The increasingly difficult position in regard to importation and shipping facilities and the rise in prices had a further hampering effect on the acquisition of supplies for local consumption, with the result that in 1941 the fertilizer consumption of the Union fell to 280,000 tons, of which 230,000 tons were *superphosphate*.

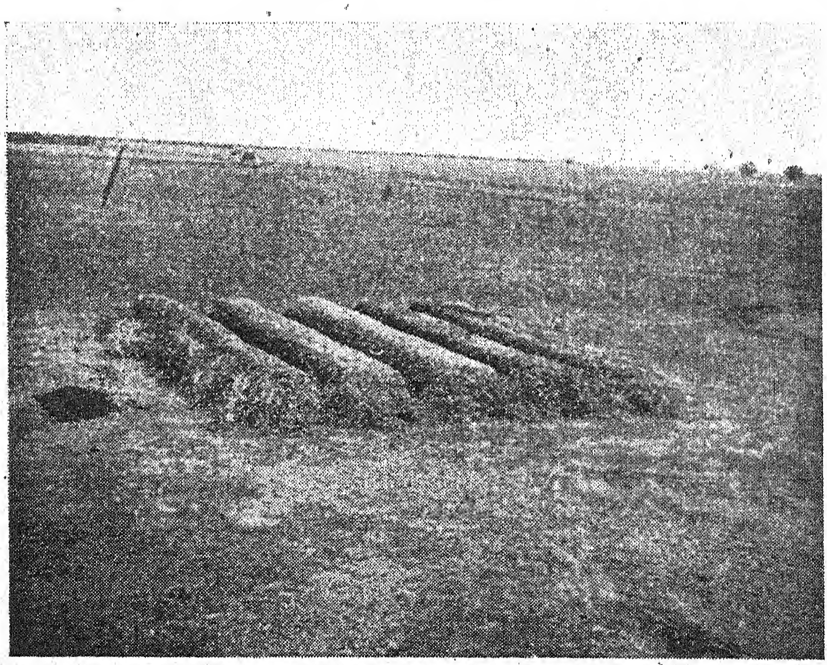
Except for the regular supplies of rock phosphate from the Red Sea area, very little was imported from elsewhere during the first half of 1942. The first mentioned importations cannot, however, be increased beyond a certain limit, and the total maximum supplies of superphosphate available for 1942 will, therefore, be still lower than those of last year. On the other hand, there was a tremendous increase in the demand owing to the campaign for increased food production, the higher prices for farm products and the lower prices for fertilizer as a result of the subsidy. Precise figures are not available, but it may be assumed that orders up to the beginning of August have already exceeded the total possible production for the whole year.

In the circumstances, *rationing* was unavoidable. In point of fact, as far back as May, fertilizer dealers deemed it necessary to apply rationing to a certain degree. After consultation with the Fertilizer Advisory Committee and the Fertilizer Traders' Association, however, it was decided to introduce a more comprehensive system of rationing, and fertilizer dealers were requested among other things to delay consigning to areas where late planting could still be made. Arrangements have also been made to obtain a complete statement from all farmers for 1943 so that a more effective system of distribution can be worked out.

As regards the possibilities of *exploiting the local sources of rock phosphate*, it may be stated that extremely useful work was done dur-

ing the year. An investigation was carried out into the practicability of using the Langebaan rock-phosphte deposits, and although it appeared that the phosphoric oxide content of the phosphate was too low for its conversion into superphosphate, experiments showed that it is fairly readily accessible. At present a company is considering the establishment of an organization to mine and mill the rock on an extensive scale. It is hoped that considerable quantities of the rock will be available towards the middle of 1943. By mixing this with superphosphate, a mixture is obtained which can be applied in the same quantities as superphosphate alone, so that the shortage of superphosphate can be considerably supplemented in this manner. Renewed attention was given to the Palaboroa rock phosphate deposits. In the past, this rock appeared to be unsuitable for direct application to the soil. There are reasonably good prospects, however, that it can be converted into superphosphate, and an investigation was therefore undertaken to determine whether its use for the manufacture of superphosphate will be justified as a war time measure. The results have shown that the development of these deposits will not be an economical proposition.

In regard to *other fertilizers*, the position during the past year was very difficult. Potassium sulphate to which preference is given by tobacco growers, potato farmers and many others, was and still is altogether unobtainable. An exceptionally large shipment of potash fertilizer is on its way to the Union, however, and if it should safely reach this country, there should be no shortage of potash dur-during 1943. Although there was a serious shortage during 1942 of the best known nitrogenous fertilizer, namely, ammonium sulphate, arrangements have now been made with Great Britain and the United States of America to transport a considerable quantity to the Union



Compost Heaps at Rust-ter-Winter.

during the course of next year. If this quantity is successfully landed here, the position should not be too difficult.

In connection with the provision of nitrogenous fertilizers mention must also be made of the fact that farmers are now making greater use than ever before of *Karoo and kraal manure*. The Railage rebate of 90 per cent. which is allowed on such manure is of great assistance in this respect. In view of the shortage of rolling stock, however, this rebate will no longer be granted after 1 October where manure is hauled over long distances but only when railage is effected in accordance with an already approved regional zoning scheme. Although this arrangement will promote the more effective utilization and distribution of the available supplies, it may occasionally result in individual consumers not obtaining all their manure requirements.

It is also necessary in this connection to refer to the campaign recently launched with the object of encouraging municipalities throughout the country to manufacture *compost* from all kinds of municipal refuse, including night soil. This work is already in full swing and it is hoped that it will make a useful contribution towards meeting the general fertilizer needs of the country. Comprehensive steps will also be taken shortly to encourage the making of compost on farms, in order that this desirable practice might become much more widely established among farmers.

Although the fertilizer position is presenting considerable difficulties, everything possible is being done to obtain supplies, to regulate distribution, to maintain prices at a reasonable level for the producer, and to develop new sources and new methods of manufacture.

Publicity Work.

As the torch bearer of all the activities which must be carried out by the Food Control Organization and the Department in these difficult times in the national interest, and more particularly in that of the producer and the consumer, there is still the Publicity Section. The main object of this publicity work is to bring to the attention of the entire nation all available information in connection with food production, the proper and economical use of products and implements, the replacement of unprocurable requisites, and the care of the family.

By keeping in close touch with all sections of the Food Control Organization, with control boards, producers and consumers, it is the task of the Publicity Section on the one hand, to bring food problems to the notice of the bodies concerned and, on the other, to provide the public with all essential information in regard to production and nutrition. By means of the radio, press, "Farming in South Africa", correspondence and personal contact, every effort is being made to keep the whole nation, including house-wives, fully informed of current events affecting their interests.

The most important and most effective means of disseminating information among the public is by *personal contact*. This is done by addressing meetings in all parts of the country which require immediate attention. With the assistance of the technical officers of the Department, all local problems are dealt with as effectively as possible. Up to the present, special attention has been devoted to the potato, wheat and maize areas, but in course of time all parts of the Union will be visited. Indeed, the extension and other field officers of the Division of Animal and Crop Production have been

placed at the disposal of the Food Control Organization in order to enable the Production and Publicity Sections to maintain the closest contact with farmers and the farming industry. On the one hand, the extension officers, field officers, colleges of agriculture, etc., are continually kept abreast of all developments and events which concern the Organization so that they can impart the latest information of the farming community while, on the other, they can collect firsthand information on the difficulties of the farmers. There is, therefore, a continual interchange of information, and both the farmers and the Food Control Organization are kept well-informed.

In order to take the dissemination of information yet another step further, food-production committees are set up in all the districts visited, with the object of assisting the Food Control Organization. These committees consist of farmers and serve not only as further instruments of disseminating information, but also as links to bind the organization and farmers more closely together.

That the system of personal contact has proved extremely successful is evident from the numerous requests for more meetings. In fact, there is every indication that under the present difficult circumstances, farmers are ready to snap up and to apply as far as possible every scrap of assistance offered to them by way of advice and instruction. The numerous letters addressed to officers personally is further evidence that the country needs and fully appreciates the service of the Organization.

As regards *the radio and the other channels of publicity*, a talk which is of immediate interest to either producers or consumers is broadcast regularly every Monday and Friday evening. The dietician also broadcasts to house-wives every Wednesday at 12.30 p.m. This talk is intended to afford guidance to house-wives in connection with a healthy and balanced diet which must be maintained in spite of the fact that certain requirements are either unobtainable or must necessarily be rationed.

It is realized, naturally, that it is impossible to reach everyone by means of the radio and for that reason the talks are printed in the form of a Publicity Series and sent to all available addresses of farmers' associations, food-production committees and field officers who come into close contact with the public. These communications are quite apart from the publications which go to the State Departments, control boards, colleges of agriculture, co-ordinating regional officers, extension officers, magistrates, the general press and agricultural journals. So far no fewer than 40 broadcast talks and 23 special press statements have been issued on a great variety of food and other cognate matters.

In addition to technical advice, much publicity is also given to schemes relating to rationing and the procedure which must be followed in order to obtain certain requisites, as for example, in the case of fertilizer, maize and seed.

Co-operating with the Publicity Section there is also the *Nutrition Committee* which was established with the object of giving house-wives all possible assistance during the present period of scarcity and shortage by means of available information, with a view to encouraging sound nutrition, organized purchases, and the economical use or substitution of requisites which are no longer easily obtainable.

The drawing up of a simple standard for balanced diets was one of the first undertakings of this committee. It is very necessary that house-wives should be given guidance in this direction so that the

 [*Continued on page 56.*

Errors in Milk and Cream Testing.

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ERRORS in milk and cream testing may be classified into the following groups, viz.: (1) sampling errors; (2) acid errors; (3) centrifuging errors; (4) temperature errors; (5) reading errors.

Sampling.

It is all important that the sample be truly representative of the whole mass of milk or cream to be tested. To this end the whole mass of milk and cream must be thoroughly mixed, so that the fat is uniformly distributed.

When cream which is very thick or which contains visible curd particles, arrives at the factory it is difficult for the tester to obtain a representative sample in the time at his disposal under practical working conditions, and it is impossible for the butter-maker to treat the cream as he would like to do. Farmers should therefore assist the factories by paying proper attention to the milk and cream to ensure that it arrives at the factory in the best possible condition. The milk and cream tester tries to give particular attention to the sampling of all milk and cream to ensure fairness, but his time is limited.

Samples must be kept in a cool place in clean well-stoppered bottles to obviate evaporation, since this will increase the test. Composite samples must be put in suitable air-tight jars to prevent evaporation of water, and be kept in a cool *dark* place. Sunlight may cause the formation of a tough cream layer which will make the pipetting of a sample for testing somewhat difficult. For this reason, when the daily sample of milk is added, the contents of the jar should be gently mixed to prevent the cream that rises on standing from becoming tough.

The composite sample should be warmed to 100°-110° F. for a few moments and then cooled to 70° F. and well agitated before pipetting.

Acid.

Errors under this heading are numerous and lead to discouraging results, especially in the Babcock tests. Acid should not only be of the required density, but should be free from impurities, such as pieces of cork and sediment.

Care of acid.—Since sulphuric acid absorbs moisture from the air, it must be kept in a closely-stoppered, labelled vessel; and because it chars cork and rubber, glass stoppered bottles should be used for holding it.

Provided the density is correct, if more than 17·5 c.c. are used the result will be that the test will have a charred or blackened appearance, and the action, even on the fat, will be such that the test will be reliable.

A somewhat similar result may be obtained if the temperature of the milk and of the acid is too high, for heat increases the oxidising power of the acid. If the acid is too strong, the tests will also be charred unless a smaller amount is taken, while if the acid is poured directly on to the milk instead of being run down the neck of the flask to form a distinct layer below the milk or cream, the result will also be a charred one.

Strength and temperature.—If the acid is too weak, too cold or if too little acid of the proper strength is used, the casein and milk

sugar will not be completely oxidised, and hence the fat will not be completely freed from the other solids. This may be seen in the completed test which will show pieces of light-coloured oxidised curd that float up into the neck of the flask with the fat, making it difficult or impossible to estimate the correct amount of fat.

If more acid is used, the result will be the same as when the acid is of greater density or strength, but it is not possible without experimenting to know exactly how much extra acid should be added. It is much wiser to endeavour to increase the density of the weak acid by adding the necessary amount of stronger acid and to test the density with a hydrometer specially designed for the purpose.

This may be done simply by leaving off the stopper of the bottle. Sulphuric acid has a high affinity for moisture and will absorb moisture from the air and in this way become weaker. It is, however, better and quicker to weaken acid by adding a weaker sulphuric acid or water. When this is done, is should be remembered that the *acid must be added to the water* and not the water to the acid. (If water is added to the acid, the reaction between acid and water will prove too violent and may result in accidents.) After dilution by adding acid to water, check the density.

Centrifuging.

The object of using centrifugal force is to separate the fat from the residue, which is heavier than the fat, and so bring the fat into graduated scale on the neck of the bottle. If too little centrifugal force is used, all the fat will not be thrown into the neck of the bottle and the test will be inaccurate. This happens more particularly when hand machines are used, and especially if they are not sufficiently firmly fixed to allow of a proper speed being maintained. Whirling the machine somewhat longer will correct this.

On this point the following table, prepared by Farrington and Woll, will act as a useful guide as to what speed should be maintained :—

Machine with disc diameter of	Revolutions per minute
10 inches	1,074
12 inches	980
14 inches	909
16 inches	848
18 inches	800
20 inches	759

The speed may be ascertained by using a revolution counter to determine the number of revolutions per minute, but if the operator has not got a speed gauge, the number of revolutions the bottle holder makes may be determined on a hand driven machine by making one complete revolution of the handle, and counting the number of revolutions which the bottle holders make. The speed of the bottle holders may then be calculated by multiplying the number of revolutions the bottle holder makes during each turn of the crank handle, by the number of times the crank handle is turned per minute.

Temperature.

It is important to bear in mind that the specific gravity of butterfat, at temperatures ranging from say 130° F. to 150° F. is approximately ·9, and that it is on this basis that the neck of the milk or cream test bottle is graduated. When butterfat is solid its specific gravity is higher, amounting to ·93.

Liquid fat.—In order to emphasise the necessity for the temperature being kept up to approximately 140° F., so that the fat shall be thoroughly *liquid,* it may be pointed out that all the numerous fats of which butterfat is made up have different melting points, and the melting point of one of the fats, viz., palmitin, which forms about one quarter of the total butterfat, is about 142° Fahrenheit, whereas myristin, another fat present in a high percentage, melts at a temperature of 129° F. On the other hand, the fat present in the largest quantity is Oleïn and it becomes liquid at 40° F.

It must be clearly understood that the above are the temperatures at which these fats would become liquid if they were isolated; when, however, they form part of the whole butterfat, the melting point of the combination is not nearly as low as that of the first-melting fat or as high as that of the fat which is most difficult to bring to melting point. Consequently butterfat *as a whole* becomes somewhat liquid at a temperature approaching 100° F., and at 120° F. it is thoroughly liquid.

Errors may also occur through mistakes in temperature at various stages from the taking of the sample of milk up to the reading of the test; in fact all operations are dependant on correct temperatures being used. Milk expands on heating and contracts on cooling, and hence when a pipet full of say 17·6 c.c. is drawn, the well mixed sample must be approximately at 70° F. If the sample is too cold, the test will tend to be high; if the milk is too hot the expanded volume will result in a low fat test.

If the milk is too hot, and especially if the acid is warm and full strength, the effect will be somewhat the same as when too much acid is used. This, however, seldom occurs, save on a hot summer's day and when the acid is kept in a warm place.

When the acid is added and the sample thoroughly oxidised, great heat is evolved, but when several samples have to be done at the same time, unless the earlier ones are placed in a warm bath (either of hot water or steam) they lose heat, especially in cool weather and the result of the test will be unsatisfactory. The action of the acid *continues* for some time *after* the milk solids appear to be dissolved, and if the temperature is allowed to become too low, the action is considerably reduced and the fat particles will not readily separate out from the mixture. Also, unless the temperature is high, the fat globules will experience considerable friction in endeavouring to get to the surface.

Where steam for driving the Babcock centrifuge is used, this difficulty is frequently overcome by the extra heating power of the steam during the process of whirling the samples, but when a hand machine is employed and only hot water is used to keep up the temperature, it is very advisable to place the samples in hot water immediately after the solids have been dissolved, if there are more than half a dozen to put through.

Even if the samples are quite hot enough when put into the machine, if the temperature is allowed to drop while the samples are in the machine, the fat will, for reasons given above, not all be completely separated out from the other constituents in the bottle and a clear reading will *not* be obtained.

The temperature of the water to be added must be between 160° F. and 180° F. or the temperature of the mixture will not be maintained, and the " fat column " will not be clear. This also applies to the second addition of water where temperature is just as important a consideration.

Too much heat is possible, and in some steam-driven machines the temperature becomes so great that the fat is unduly expanded. When that happens the specific gravity is less than the basis adopted in calibrating and graduating the bottle, and thus, unless the samples are cooled down somewhat prior to being read, too high a result will be obtained, especially in the case of cream testing.

If clean, pure, distilled water is not available, soft rain water may be used. Hard water may seriously affect results and make accurate reading very difficult. However, objections to hard water may, in most cases, be overcome by thorough boiling or by previous treatment with a few drops of sulphuric acid.

If foam appears on the top of the fat column, as a result of the gas liberated when hard water containing carbonates is used, a few drops of alcohol put in the top of the fat column will cause the foam to disappear and produce a sharp line of demarcation between the fat and the alcohol. The reading, however, *must* be taken *without delay* or the fat and alcohol will mix and increase the height of the fat column, thus producing incorrect results.

Reading.

Closely associated with errors in temperature are those which are made in reading, because the majority of errors in reading occur through samples being read off at greatly varying temperatures. This takes place more particularly when a large number of samples have been done, resulting in some time being taken to read them. Under these circumstances the samples should, in order to ensure accuracy, be placed in a hot water bath at a temperature of 140° F. and read off from there.

Other errors in reading occur through not following the directions laid down in the technique; for instance, not reading Babcock milk tests from the bottom of the lower meniscus to the top of the upper meniscus, Gerber tests from the lower line of the fat column to the bottom of the meniscus, and cream tests from the bottom of the lower meniscus to the bottom of the upper meniscus.

One often sees test bottles with the graduations on the neck invisible or at least very difficult to see. It is always advisable for the tester to use a soft pencil, not indellible, and rub it over the graduations to bring out the graduations clearly and facilitate accurate reading.

To ensure a clear fat column and accurate tests and reading, it is furthermore important to cleanse all bottles thoroughly. This is best done immediately after testing by thorough shaking to liberate precipitation at the bottom of the bottle before discarding the contents. Then rinse out with warm water containing some dairy cleanser such as Dairyene, Masilia, Wyandotte, Otklaar Solvay, or washing soda. This solution must not be too strong, as glass is to some extent soluable in strong alkalies, and if the solution is too strong, the indentations on the graduated scale will be removed, making accurate reading most difficult. Always, therefore, finally rinse in hot water to free the bottles and glass of alkali. Turn the bottles upside down to drain dry.

At times difficulty is found in freeing glassware of black burnt material or white precipitation. In such cases, it is advisable to put fine clean sand or bird-shot in the alkali solution, and gentle shaking will rea[illegible] remove the precipitated material. Do not shake carelessly or vi[illegible]usly since the bottles are easily broken.

Draught Horses.

I. Colour and Qualities.

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IN spite of the mechanization of the bulk of modern transport, good draught horses have not lost their usefulness or their attraction. While horse-drawn vehicles are a hindrance in heavy city traffic, much use can still be made of draught horses in smaller towns where they will be found to be economical for work in which short hauls and frequent stops are necessary. But the greatest service can be rendered by draught horses on farms, and especially on smaller farms, on which they will help to complete the make-up of diversified farming systems.

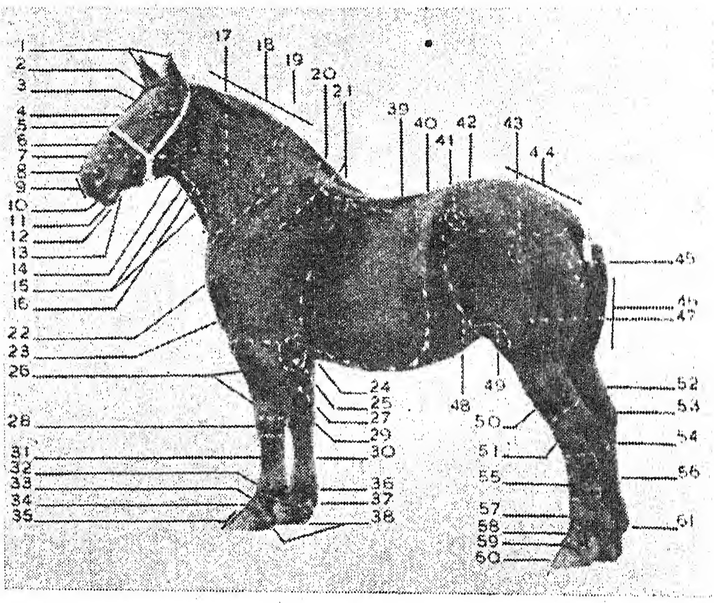

FIG. 1.—Regions of the Horse.

1. Ears.
2. Forelock.
3. Temple.
4. Eye.
5. Nose.
6. Cheekbone.
7. Cheek.
8. Nostril.
9. Muzzle.
10. Upperlip.
11. Lowerlip.
12. Chin.
13. Chin-groove.
14. Throat.
15. Windpipe.
16. Jugular groove.
17. Neck.
18. Crest.
19. Vase of neck.
20. Withers.
21. Shoulder.
22. Point of shoulder.
23. Breast.
24. Brisket.
25. Elbow.
26. Forearm.
27. Chestnut.
28. Knee.
29. Back of knee.
30. Back tendons.
31. Cannon.
32. Fetlock.
33. Pastern.
34. Coronet.
35. Wall of foot.
36. Ergot.
37. Hollow of heel.
38. Heel.
39. Back.
40. Loin.
41. Point of hip.
42. Point of croup.
43. Hip joint.
44. Croup.
45. Point of buttock.
46. Buttock.
47. Thigh or quarters.
48. Flank.
49. Stifle.
50. Gaskin.
51. Hock.
52. Hamstring.
53. Point of hock.
54. Chestnut.
55. Cannon.
56. Back tendons.
57. Fetlock.
58. Pastern.
59. Coronet.
60. Wall of foot.
61. Ergot.

In this article stress is laid upon the usefulness of *good* horses. The keeping of fewer horses in order to ensure concentration upon the rearing of high-quality animals is recommended, and it is strongly advocated that horses be bred only in areas most suitable for the purpose.

Throughout the world, in horse husbandry perhaps more than in any other phase of animal husbandry, the horseman or attendant contributes more than any other single factor to the efficiency and success of the horse section. For this reason the need for personal care and supervision is imperative. This point is of prime importance, especially in this country where, owing to circumstances peculiar to the Union, the great majority of managers and stockmen have an inadequate knowledge of the fundamental points of a draught horse. Some facts of practical value will therefore be given in the hope that they will prove useful to the student and to the novice and that they will be of some interest or value even to the experienced horsemen.

Regions of the Horse.

The regions of the horse are indicated in Fig. I. and should be carefully noted since reference will frequently be made to them in this article.

Colour-names and Descriptions.

The following terms and descriptions which are applicable to breeds of horses were supplied by Dr. J Quinlin, Assistant Director of Veterinary Services, Onderstepoort, and have been approved by the Faculty of Veterinary Science, University of Pretoria.

The term "whole colour" is used when the colour of the horse's coat is uniform throughout; that is, when there are no hairs of any other colour on the body, head, or limbs, as for example, in the case of the chestnut colour in the Suffolk.

(1) *Black*.—Black pigment is general throughout the body coat, limbs, mane, and tail, with no pattern character present other than white markings.

(2) *Black-Brown*.—The predominating colour is black, with muzzle and sometimes flanks brown or tan.

(3) *Brown*.—There is a mixture of black and chocolate pigment without yellow in the body coat, with black limbs, mane, and tail.

(4) *Bay*.—Considerable variation occurs, from a dull red approaching the brown to a yellowish colour approaching the chestnut. The bay has a black mane and tail and invariably black on the limbs. The variations encountered are bay-brown, dark bay, light bay, mealie bay.

(5) *Chestnut*.—This is a whole colour of which three shades are recognised, viz., Chestnut: includes bright, golden and red chestnut shades; dark chestnut: includes liver and mahogany chestnut shades; light chestnut: includes sorrel.

(6) *Grey*.—The body-coat is a varying mosaic of black and white hairs with the skin black. There are many variations of grey colour. The coat always grows lighter with increasing age.

(7) *Blue Dun*.—The colour of the body is a dilute black evenly distributed over the body (giving a blue effect) with or without dorsal band (list) or withers stripe. The skin is black and the mane and tail are always black.

(8) *Yellow Dun*.—There is a diffuse yellow pigment in the hair with or without dorsal band (list), withers stipes, or bands on the legs. The striping is correlated with stripings on the head and limbs.

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When striping is absent, the limbs will approximate the colour of the body coat. The skin is black.

(9) *Cream.*—The body coat is a cream colour, the skin is unpigmented. The iris is deficient in pigment; it may even be devoid of it, giving the eye a pinkish appearance.

(10) *Roans.*—Roans are distinguished by the ground or body colours, all of which are permanent. *Blue roan*: the body colour is black or black-brown with an admixture of white hair which gives

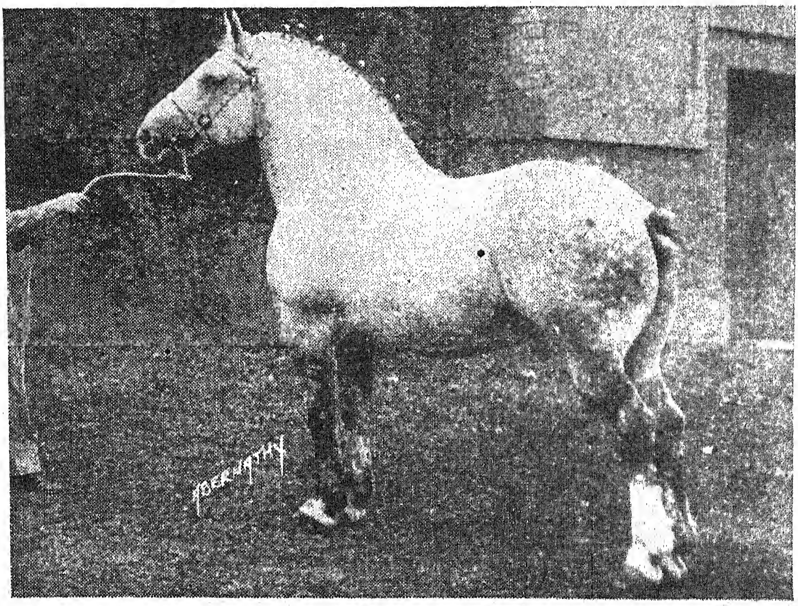

Fig. 2.—Percheron stallion 'Marceau'. Owner Ralph Smith, Stanby, Kansas, U.S.A.

a blue tinge to the coat. The limbs from the knee and back downwards are black. *Bay or red roan*: the body colour is bay or bay-brown with an admixture of white hairs which gives a reddish tinge to the coat. The limbs from the knees and back downwards are black.

Strawberry or chestnut roan: the body colour is chestnut with an admixture of white hairs. The limbs are not black.

(11) *Piebald.*—The body coat consists of large irregular patches of black and of white. Generally the line of demarcation between the two colours is well defined.

(12) *Skewbald.*—The body coat consists of large irregular patches of white and of any definite colour except black. The line of demarcation between the colours is generally well defined.

(13) *Odd Coloured.*—The coat consists of a mixture of more than two colours tending to merge into each other at the edges of the patches with irregular body markings not classifiable under the sections piebald and skewbald.

Qualities of a Draught Horse.

The draught horse must be strongly built in order to perform its function efficiently. Mature, well-conditioned draught horses generally weigh between 1,600 lb. and 2,000 lb. The ideal draughter is broad, deep, fairly low-set, symmetrical throughout and well muscled, showing ample quality, good style and smart action.

The temperament of the draught stallion is animated and masculine, and the stallion should be active and alert, yet not nervous and irritable. The mare is less active, and mares vary greatly in disposition.

The head of the horse indicates qualities such as strength, character and intelligence. Its size should be in proportion to that of the body. The eyes should be large and clear and the ears of medium length.

The neck should be of medium length and neatly attached to the shoulders. Sure-footed horses generally carry their heads moderately high.

Good shoulders are essential. Deep, muscular shoulders laid on at a slope of about 45 degrees are associated with a free, determined stride. Straight shoulders are undesirable, because they are indicative of less power and are frequently injured by the harness collar which can never be fitted satisfactorily in such cases. Straight shoulders are often associated with short, straight pasterns which cannot stand the same amount of work as sloping pasterns, owing to the greater concussion on hard roads resulting in bone and tendon trouble in feet and legs. Horses with straight shoulders are usually subject to stumbling.

Combined with good shoulders, a full, deep chest ensures the desirable placing of the fore-legs.

Draught horses with deep, well-sprung or roundly arched ribs generally have a roomy barrel, a strong top, and a neat underline.

The following features are indicative of strength: A well-muscled short, broad back and loin, and a short coupling, i.e. the space between the last rib and hip. The croup should be broad and long and fairly level from the hips to the point of setting of the tail. The thighs and gaskins should be heavily muscled, the flanks low and the hips smooth and in general keeping with the horse.

A short and sloping croup is usually not as well muscled as a long croup with a slight slope. In addition, in the case of the latter conformation, the legs are set well back where they belong.

Sufficient emphasis cannot be placed on the importance of the need for strength and soundness of the legs and feet.

The size of bone and the feet should be adequate for the weight which they support. Clean-cut, well-defined, large joints free from "gumminess or meatiness" are desirable.

The fore-arm should be well muscled. The knee should be large, straight and angular.

The cannon region should be short and flat, indicating that the tendon is set well back from the bone.

The pasterns, when viewed from the side, should be of moderate length. Few horses have too long and too sloping pasterns; most pasterns are too short and upright. They should be clean and free from fulness.

The feet should be large at the ground surface and the coronet. The hoof-wall should be devoid of cracks and breaks and should give the impression of having hard-wearing qualities. Dark-coloured hoofs are favoured by many horsemen as they are thought to denote great endurability. An examination of the sole of the foot should reveal slight concavity with well-defined bars to prevent contraction of the heel which should be wide and strong but not high. The frog should be well developed and plastic. The hock should be clean and flat or clear from any puffiness.

The hind pasterns and toes are slightly shorter than those of the fore-legs, and the toe-axis forms a slightly greater angle with the ground. The hind hoof is not quite round, having a tendency to be broader towards the posterior aspect of the quarters and somewhat pointed at the toe.

The action of the draught horse is most important. The horse should be viewed as he walks away. Normal straight action will be evidenced when the legs are straight and properly placed and the feet are well balanced. The feet should be lifted with a snap and the joints flexed so that when viewed from the rear the sole shows plainly. The feet should be moved straight forward freely, but without a dishing or winging action; the heel and toe should strike the ground at the same time and there should be no indication of the feet being twisted when in contact with the ground. The hocks should be carried fairly close together. There should be no "brushing" and the hind feet should not be placed outside the marks made by the front feet. The horse's stride should be long, indicating boldness and determination. At the trot, the horse should show the same well co-ordinated movement, the feet and legs being under complete control and the body moving forward in a straight and smooth manner. Viewed from the side the horse should be seen to move with an energetic keenness and a proper flexing of the joints.

Generally speaking, the usefulness and consequently the price, of a horse depends upon the following five important points:—

Soundness.—Soundness is especially important if the horse is required for work and not for breeding alone. Horses with serious hereditary unsoundnesses should not be used for breeding purposes. The sounder the horse, the greater will be its staying power. Of course, the more defects or unsoundnesses it has, the less will be its value.

Age.—Horses can be started on light work at just over 2 years, preferably at 3 years. For hard work a horse should not be younger than 5 years. The value of the work-horse begins to depreciate when it reaches the age of about 8 years, but many horses which have received good care are still useful at the age of 20 years and over. From the point of view of breeding, age is also of importance. Generally mares are satisfactory breeders until they are 15 years old; but there are records of draught mares that have produced excellent foals at 25 years of age.

Size and General Appearance.—Other things being equal, the heavier a horse, the greater will be its value for draught purposes; undersized horses seldom realize high prices. General appearance is greatly influenced by trueness to breed and type.

Breeding.—The pure-bred horse quite rightly commands a higher value. Available capital to be invested must decide whether pure breeds or crosses are to be purchased. A well-bred horse generally has good natural manners.

Temperament.—In temperament the draught horse is generally phlegmatic, but not necessarily sluggish. Draught horses are alert and active in their movements when handled properly. Points of unsoundness are usually somewhat difficult to determine.

Produce Clean Milk.

E. D. Adler, Lecturer in Animal Husbandry, College of Agriculture, Glen.

EVERY dairy farmer knows that it is in his own interest to produce clean milk. He therefore does everything in his power to produce a pure product in a hygienic manner. Milk is, however, exposed to many dangers of infection. Mastitus, for instance, which causes an enormous annual waste of milk, is spread mainly by means

A One-legged Milking stool.

of the hand of the milker—an instrument which is capable of transmitting every form of infection and dirt.

Because our milking is, for the most part, done by natives who do not understand the most elementary principles of cleanliness and bacterial purity, our efforts to produce clean milk are not always as successful as we would expect them to be. Careful farmers will see to it that the milkers put on clean overalls for milking and that they wash their hands in a disinfectant after each cow has been milked. But all this good work may be undone by the milker who picks up his milking stool with a hand wet from milking an infected cow, carries it to the basin containing the disinfectant, washes his hands, and grasps the stool at exactly the same spot as before in order to carry it to the next cow to be milked.

Dairymen must realize from the start that they have to work with unskilled labourers and that every effort should be made and plans devised to keep all milking activities as simple, practical and hygienic as possible.

The following practical suggestion may prove very useful to dairy farmers:—

At Glen, a type of one-legged milking stool is being used with great success. It is attached to the milker in such a way that he can

sit down on it or get up and walk about without touching it with his hands. The principle is quite simple. Use any kind of leather belt. Fasten this around the milker's waist in such a way that it fits comfortably. Two flat straps, approximately 9 in., long, are attached to the belt just over the hips. The stool may then be attached to the loose ends of these straps by means of rings or buckles in such a way that it hangs behind the milker's seat.

The stool itself can be made of wood. For the circular seat, 9 inches in diameter, use strong wood, 1 inch thick. The leg, which should be 9 inches long, is fixed to the centre of the seat with strong screws. The stool should not be too heavy but must be strongly made and heavy enough to hang properly.

Natives who have been accustomed to three or four-legged stools, will at first make all kinds of objections, but they will soon learn to be satisfied with the new arrangement.

New Conditions and the Agricultural Industry:—

[*Continued from page 45.*

best use can be made of available products. Several highly technical standards already exist, but under prevailing conditions it is necessary to place all information before the public in the simplest possible form. With such a basis on which to work, balanced diets can be drawn up in terms of foods, such as potatoes, meat, milk, etc., instead of calories, vitamins, minerals, proteins and carbohydrates. Good progress has already been made with this work.

The Nutrition Committee has also undertaken to obtain the co-operation of all existing organizations interested in the sound feeding of families, particularly as regards the less priviliged classes. To this end the Red Cross, St. Johns, Reddingsdaad, A.C.V.V., O.V.V., War Service, Social Workers, Women's Federation and Women's Agricultural Unions have already been approached. It is hoped that these organizations will be willing to co-operate. The proper and sound feeding of the nation is a matter of national importance, whether there is a war on or not, and it is in the full realization of this fact that the subject has been tackled. It is gratifying to be able record that all departments concerned with this great problem are already giving valuable assistance.

ERRATA.

Read Price (shillings) of ration B, page 790, December issue as follows: 0·60; 0·25 and 1·00; Total 1·85.

A Popular Bulletin for the Housewife.

Bulletin 237.—"Eggs and Poultry in Cookery." Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria, at 6d. per copy.

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 | JANUARY 1943 | No. 245

CONTENTS

* Price Review for November, 1942.

SLAUGHTER STOCK.—The seasonal rise in prices of slaughter cattle continued and was this year further accentuated by the relative smaller supplies forthcoming and the present greater demand. Thus ordinary primes on the Johannesburg market were 78s. 2d. per 100 lb. estimated dressed weight *on the hoof* as against 71s. 3d. for October, and good mediums were 69s. as against 65s 6d. On the Durban market No. 3 averaged 47s. 6d. per 100 lb. dressed weight *on the hook* for November and undergrade 38s. 7d. It must be pointed out that with the price fixation of meat and the accompanying compulsory grading, the basis of price reporting on the Durban market has been changed. In the case of beef, although not strictly comparable, ordinary primes are now classed under Grade 1. Good mediums as Grade 2, Mediums as Grade 3 and Compounds and Inferiors as unmarked or undergrade.

The supply of slaughter sheep was also very moderate, especially as regards primes, and prices on the Johannesburg market showed a further rising tendency, while on the Cape Town market prices changed little of nothing, but remained firm on a very high level. Prime merinos on the Johannesburg market were 12·9d. per lb. estimated dressed weight *on the hoof*, and 10·5d. per lb. on the Cape Town market. Pig prices also rose further. Prime porkers on the Johannesburg market rose from 7·7d. per lb. live-weight in October to 8·3 per lb. in November, and baconers from 8·3d. to 8·6d. per lb.

Grains.—Maize was still very scarce, but as regards oats and rye, the position has changed a good deal as a result of the marketing control measures and the price fixation of these two products at the beginning of the month (for details see the December 1942 issue of "Crops and Markets"). Where the average selling price or rye

* All prices mentioned are average.

in Cape Town was 31s. 8d. per bag in October, it was 23s. 5d. per bag in November. In the case of oats, however, the price did not drop much and averaged 15s. 7d. per bag in Cape Town during November Dry peas on the Johannesburg market were exceptionally scarce, while dry beans were present in fair quantities. Nevertheless, prices of the latter also remained firm and sales were brisk. Cowpeas averaged 27s. 1d. per bag and speckled sugar beans 38s. 6d. per bag for November. Kaffircorn was also very scarce and dear.

Foodstuffs.—Lucerne hay and oat hay were plentiful, although the quality on the whole was poor and prices consequently declined considerably. On the Johannesburg market Transvaal lucerne hay was 4s. and Cape lucerne hay 5s. 1d. per 100 lb. for November as against 6s. 7d. and 6s. 3d. per 100 lb., respectively, for October. Teff grass and sweet grass were scarce and prices rose, e.g., for teff grass on the Johannesburg market from 5s. per 100 lb. in October to 5s. 5d. in November.

Potatoes.—Rapidly increasing quantities on all markets, especially towards the end of the month, caused prices to drop appreciably everywhere. In many cases the supply was much bigger than the demand. On the Johannesburg market, for example, Transvaal No. 1 declined from 21s. 3d. per bag during the previous month to 16s. 10d. in November. With N.M. grade 1, No. 2 and 3, the decline was from 24s. 6d. and 24s. 4d. to 18s. 3d. and 18s. 8d., respectively. Cape No. 1 on the Cape Town market was 18d. 10d. per bag as against 22s. 10d. for October and Natal No. 1 on the Durban market was 21s. 4d. as against 24s. 11d.

Onions.—Large quantities of locally produced onions, further supplemented by regular consignments of Transvaal onions also caused prices to decline sharply in this case. Transvaal onions on the Johannesburg market declined from 17s. 10d. to 11s. 11d. per bag in November and Cape Onions on the Cape Town market from 25s. 11d. to 17s. 10d.

Vegetables.—Fairly large quantities of lowveld vegetables, especially squashes, vegetable marrows and cucumbers, were still present on the Johannesburg and Pretoria markets, although supplies were much smaller than during the previous month. On the other markets, however, locally produced vegetables were predominant. On the whole, prices were on a considerably lower level than during the previous month.

Tomatoes.—Fairly large consignments of Transvaal totamoes were still present on all markets, although the quality was much poorer. Locally produced tomatoes appeared during the second half of the month. The demand was excellent and, on the whole, prices showed an upward tendency. On the Johannesburg market, N. M. rose from 2s. 6d. per tray in October to 3s. 6d. per tray in November, and ordinary tomatoes from 1s. 5d. to 2s. On the Cape Town and Durban markets prices rose from 2s. and 1s. 4d. to 2s. 8d. and 1s. 10d., respectively.

Fruit.—Supplies of apricots, peaches and plums increased appreciably towards the end of the month, but on account of a very excellent demand, prices remained high. Oranges, especially Valencias and seedlings, were still the most important fruit on most markets, although suplies were smaller than during the previous month. The warm weather, however, caused competition to be

exceptionally sharp and prices rose appreciably. On the Johannesburg market, Valencias were 4s. per pocket, as against 2s. 7d. the previous month; on the Cape Town market 3s. 7d. as against 3s. 1d., and on the Durban market 3s. 6d. as against 2s. 11d. in October. Generally speaking, tropical fruits were scarce, only pawpaws and grenadillas being fairly well represented.

Eggs.—Eggs were reasonably well supplied, although supplies were somewhat smaller than during the previous month, and prices accordingly showed a further rising tendency. New-laid eggs on the Johannesburg market were 1s. 5d. per dozen, and on the Durban market 1s. 7d. per dozen.

The Index of Prices of Field Crops and Animal Products.

This index, as is shown elsewhere in this issue, remained unchanged at 147 for the month of November, a compared with the previous month. Nevertheless, the indices for the respective groups of products showed quite a number of incerases and decreases during November as compared with October.

The most important increases occurred in the indices:—

(*a*) *Winter cereals*, viz. from 139 to 154 in November. This rise was caused by the higher fixed prices of wheat for the new crop and which came into operation from November. (For particulars regarding the new fixed wheat prices see the December 1942 issue of "Crops and Markets");

(*b*) *Slaughter stock.*—The continuation of the seasonal advance in the prices of slaughter stock, and especially of slaughter cattle, caused this index to rise again, viz., from 181 in October to 187 in November;

(*c*) *Poultry and poultry products.*—This index rose from 141 to 146 in November.

The most important decreases occurred in the indices of:—

(*a*) *Hay*, viz., from 156 to 134, especially as the result of good rains which caused pasturage to improve appreciably, thus decreasing the demand for dry fodder. Furthermore, greater supplies of lucerne hay came on the markets.

(*b*) *Other field crops* (i.e., potatoes, onions, sweet potatoes and dry beans) viz., from 227 in October to 189 in November as a result of the sharp fall in prices of potatoes and onions on all markets.

(*c*) *Dairy products*, from 167 to 139 in November. This decrease was the ordinary seasonal decline. The summer prices of butterfat, cheese milk and milk for condensing purposes came into operation from 1st November (for particulars see the December 1942 issue of "Crops and Markets").

Prices of Potatoes.

As prices of potatoes rose to such an exceptionally high level, a measure was introduced towards the end of November 1941, whereby the maximum wholesale price of potatoes was fixed by the Price Controller at 25s. per bag under certain conditions, and the maximum retail price at 1s. per 5 lb.

This measure remained in operation up to the end of November 1942 when it was recalled, and only the maximum retail price of potatoes, excepting seed potatoes, was fixed, viz., at 1s. per 7 lb.

The maximum prices at which seed potatoes may be sold, have also been fixed. For seed potatoes accompanied by a Government A certificate, the price was fixed at 3d. per lb. for quantities less than 150 lb. and at 35s. per bag (150 lb.) for quantities more than 150 lb. For seed potatoes accompanied by Government B certificate, the relative prices were fixed at 3d. per lb. and 30s. per 150 lb.

For seed potatoes not accompanied by these certificates but by a label indicating Government inspection, the maximum prices have been fixed at 2½d. per lb. for quantities less than 150 lb. and at 27s. 6d. per bag (150 lb.) for larger quantities.

For further particulars see *Government Gazette Extraordinary* of 27 November 1942.

The Apricot Crop of 1942/43.

It is expected that the 1942/43 apricot crop will be exceptionally heavy. Of this crop, canning factories will probably take an appreciable quantity. In terms of Government Notice No. 2451 of 27 November 1942, a minimum price of 12s. 6d. per 100 lb. fresh apricots has therefore been fixed at which producers may sell to canning factories.

As in the past, all apricots which cannot be marketed fresh will be dried. The local consumption of dried apricots is between 300 and 400 tons, so that an appreciable export surplus may be expected.

It has therefore been decided to extend the powers granted to the Dried Fruit Control Board (*vide* War Measure No. 8 of 1941) for the control of the Marketing of dried vineyard produce to apply also to dried apricots for the 1942/43 season. This was effected by means of Proclamation No. 287 of 13 November 1942.

The Board will therefore take in dried apricots from producers and at prices, according to grade and quality, which are in accordance with the fixed price of 12s. 6d. per 100 lb. fresh fruit, i.e., on the basis of the same price at which fresh fruit is delivered to canneries.

The control measures will be applied in more or less the same way as those applicable to dried vineyard produce. The regulations prohibit producers of dried apricots from selling to any other person than the Dried Fruit Control Board, which will appoint agents to accept dried apricots on its behalf. Packers of dried fruit will then buy their requisites from the Board only.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON (1st July to 30th June).	Summer Cereals, (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Products. (e)	Dairy Products. (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936–37	118	86	94	93	122	86	89	98	106
1937–38	89	106	112	118	98	112	105	107	101
1938–39	92	107	96	89	79	102	106	94	93
1939–40	86	106	77	93	116	105	106	89	104
1940–41	109	113	106	159	103	108	110	112	109
1941–42	121	132	145	205	101	131	134	163	124
1941–									
January	121	115	98	121	100	104	115	96	109
February	122	115	92	115	100	104	112	107	109
March	135	115	87	125	100	104	105	125	112
April	126	116	98	167	101	106	108	151	114
May	112	116	125	160	101	109	108	157	112
June	110	116	126	183	101	111	111	150	113
July	112	118	128	241	100	130	118	145	117
August	111	118	132	216	100	130	119	109	114
September	118	118	154	228	100	130	128	108	118
October	124	119	138	268	100	128	135	115	121
November	124	137	110	250	100	128	140	118	124
December	127	137	135	199	100	122	147	128	125
1942—									
January	131	137	126	180	100	122	144	141	125
February	132	138	125	168	101	130	140	147	125
March	126	140	140	175	101	130	134	168	125
April	126	139	151	170	102	130	129	175	125
May	158	139	188	181	102	154	132	203	136
June	159	139	207	186	101	154	140	218	138
July	159	140	183	184	166	167	154	163	143
August	159	139	181	175	115	167	155	130	140
September	159	139	182	191	115	167	176	133	145
October	159	139	156	227	115	167	181	141	147
November	160	154	134	189	115	139	187	146	147

(a) Maize and kaffircorn.
(b) Wheat, cats and rye.
(c) Lucerne and teff hay.
(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls, turkeys and eggs.

Average Prices of Oranges and Pawpaws

SEASON (1st April to 31st March).	ORANGES (Pocket).							PAWPAWS (Standard box).	
	Johannesburg.			Cape Town.		Durban.		Johannesburg.	
	N.M. Navels.	Other. Navels.	Other. Valencias.	Navels.	Valencias.	Navels.	Valencias.	N.M.	Other.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	1 10	1 6	1 5	2 0	2 1	—	—	2 0	1 7
1940–41	1 9	1 7	1 6	1 11	1 10	2 4	2 1	2 2	1 9
1941–42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1941–42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1941—									
January	—	0 11	1 9	—	1 10	—	2 11	2 6	1 6
February	—	2 2	2 2	—	2 9	—	—	3 7	2 10
March	—	2 3	2 10	3 0	2 9	2 9	—	3 5	2 7
April	1 9	1 8	1 5	2 5	1 11	2 1	—	2 7	2 1
May	1 9	1 5	1 4	1 7	1 0	2 2	—	2 0	1 6
June	1 8	1 6	1 3	1 7	—	1 8	—	1 6	1 4
July	1 8	1 7	1 3	1 8	—	1 11	1 6	1 5	1 2
August	2 2	2 2	1 7	1 11	1 6	1 10	1 8	1 11	1 8
September	2 4	2 1	1 9	2 4	1 8	2 6	1 8	1 9	1 5
October	—	1 10	1 11	3 2	1 9	3 5	1 8	2 3	1 10
November	—	2 9	2 8	3 1	2 7	—	2 5	3 2	2 6
December	—	2 9	3 6	—	3 5	—	2 6	3 9	2 7
1942—									
January	—	2 6	3 8	2 10	4 7	—	3 11	3 3	2 1
February	—	3 11	4 5	4 7	6 10	3 9	5 8	6 4	3 3
March	—	3 7	2 11	6 6	5 10	4 3	5 6	4 1	3 1
April	2 1	2 0	1 10	3 4	5 0	3 4	2 6	4 0	3 1
May	2 4	2 3	2 1	2 3	2 3	2 6	1 2	3 8	3 1
June	2 3	2 3	1 9	2 1	—	2 6	1 11	2 11	2 5
July	2 5	2 5	1 11	2 1	—	2 8	1 0	2 8	2 2
August	2 11	2 8	2 3	3 0	2 4	3 6	2 4	2 2	1 8
September	2 5	3 3	2 3	3 4	2 2	4 0	2 6	2 1	1 6
October	2 9	2 11	2 7	5 1	3 1	3 7	2 11	2 4	1 9
November	—	3 6	4 0	6 11	3 7	4 6	3 6	3 1	2 6

Average Prices of Lucerne and Teff Hay and Certain Meals for Feeding.

Season (1st July–30th June).	Lucerne (100 lb.). Johannesburg (a). Cape	Lucerne (100 lb.). Johannesburg (a). Transvaal	Lucerne (100 lb.). Cape Town, Cape 1st Grade.	Teff Johannesburg. (a) (100 lb.),	Meals for Feeding: F.o.r. Johannesburg. Lucerne. (100 lb.).	Monkey Nut Cake (200 lb.).	Oats, Sussex Ground (150 lb.).	Bone, 24·8% Protein (100 lb.).	Mixed, 26·4% Protein (100 lb.). (b)
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	3 11	3 1	4 0	2 7	6 9	15 2	15 4	8 5	8 0
1940-41	4 2	3 5	4 3	3 3	6 7	15 3	14 8	11 2	8 7
1941-42	5 7	5 2	5 8	4 7	8 4	—	17 5	10 11	10 10
1941—									
January	3 9	3 2	4 0	3 9	6 6	15 0	14 6	11 0	8 6
February	3 9	2 8	4 1	2 8	6 6	14 6	14 0	11 0	8 6
March	3 6	3 0	4 5	2 7	6 6	14 0	14 0	11 0	8 6
April	4 0	3 11	5 0	2 10	6 6	14 6	14 0	11 0	8 6
May	5 3	3 10	5 0	2 10	6 9	14 6	14 6	11 0	8 6
June	5 3	4 9	5 5	3 1	7 0	15 6	15 0	11 0	9 6
July	5 2	5 2	5 10	3 10	7 6	15 6	16 0	11 0	9 6
August	5 6	6 3	5 11	3 3	8 0	—	17 0	11 0	9 6
September	6 5	6 1	5 7	3 9	8 6	16 0	17 6	11 0	9 6
October	5 8	5 6	5 1	3 10	8 6	—	17 6	11 0	9 6
November	4 5	3 11	4 11	3 6	8 6	—	—	11 0	9 6
December	5 3	4 10	4 9	4 10	7 6	—	17 6	10 6	9 6
1942—									
January	4 10	4 7	5 1	4 11	7 6	—	17 6	10 6	10 3
February	4 11	4 8	5 5	4 4	7 6	—	17 6	10 6	10 3
March	5 4	4 11	5 7	5 6	8 6	—	17 6	11 0	10 3
April	5 8	5 6	5 9	6 4	8 6	—	17 6	11 0	10 3
May	7 5	6 11	6 7	6 6	9 6	—	18 0	11 0	15 9
June	8 1	7 7	7 9	7 4	9 6	—	18 0	11 0	15 9
July	7 3	6 4	7 10	6 1	9 6	—	18 0	—	16 6(c)
August	7 4	6 4	7 10	5 5	9 6	—	18 0	—	16 6
September	7 5	6 3	7 5	5 3	9 6	—	18 0	—	16 6
October	6 3	6 7	7 1	5 0	9 6	—	18 0	—	18 9
November	5 1	4 0	6 4	5 5	9 6	—	18 0	—	18 9

(a) Municipal Market. (b) Approximately half of the protein is claimed to be animal protein. (c) Per 150 lb.

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

Season (1st July to 30th June).	Cabbages (bag). (a) Johannesburg.	Cabbages (bag). (a) Cape Town.	Cabbages (bag). (a) Durban.	Cauliflower (bag). (a) Johannesburg.	Cauliflower (bag). (a) Cape Town.	Cauliflower (bag). (a) Durban.	Tomatoes (Trays 15 lb.). Johannesburg. N.M. No. 1.	Tomatoes (Trays 15 lb.). Johannesburg. Other.	Tomatoes (Trays 15 lb.). Cape Town.	Tomatoes (Trays 15 lb.). Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940-41	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941-42	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1941—										
January	5 7	1 5	4 11	3 10	1 6	—	3 4	1 7	0 11	1 4
February	7 4	3 5	11 9	5 6	4 2	9 6	2 7	1 4	1 5	1 2
March	7 4	4 11	10 10	4 10	4 1	5 5	3 5	1 8	2 2	1 4
April	6 0	5 3	6 10	3 11	3 5	5 1	2 11	1 6	2 5	1 7
May	5 3	4 10	5 5	4 2	4 8	4 9	2 5	1 5	1 10	1 4
June	6 2	5 5	8 2	5 6	4 3	6 10	2 7	1 8	2 6	0 11
July	10 3	5 11	8 0	6 7	6 0	6 8	2 10	1 7	2 4	1 1
August	8 5	4 7	4 8	4 4	4 11	5 5	3 5	2 4	1 11	0 9
September	10 0	6 6	3 8	5 6	6 9	6 7	2 9	1 9	2 2	0 10
October	10 3	7 11	4 2	8 4	6 2	—	2 0	1 1	1 9	0 6
November	11 3	8 1	4 8	—	6 2	—	3 3	1 11	2 10	1 7
December	10 2	8 6	3 11	—	4 9	—	3 8	1 8	3 7	1 5
1942—										
January	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
September	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
October	4 2	6 10	2 5	—	4 0	5 5	2 6	1 5	2 0	1 4
November	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10

(a) Weights of bags vary, but on the average are approximately as follows: For cabbages: Johannesburg, 105 lb., Cape Town 105 lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 65 lb., and Durban 85 lb.

Average Prices of Potatoes and Onions on Municipal Markets.

Season (1st July to 30th June).	Potatoes (150 lb.). Johannesburg. Transvaal No. 1.	Johannesburg. Transvaal No. 2.	Johannesburg. N.M. Grade 1. No. 2.	Johannesburg. N.M. Grade 1. No. 3.	Cape Town. Cape No. 1.	Durban. Natal No. 1.	Onions (120 lb.). Johannesburg. Transvaal.	Johannesburg. Cape.	Cape Town. Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940–41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941–42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1941–42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1941—									
January	11 4	10 1	12 4	11 7	10 2	14 4	7 3	7 3	4 7
February	8 9	8 2	12 1	11 9	14 2	11 0	6 9	7 4	4 10
March	10 10	10 7	13 9	13 8	13 0	13 5	8 1	8 10	5 4
April	14 8	14 10	19 9	19 0	19 4	17 11	8 11	9 9	7 8
May	15 3	14 4	21 1	20 11	16 9	17 11	9 9	10 3	7 6
June	17 9	17 10	22 10	22 7	18 2	21 4	10 8	13 2	9 5
July	22 9	23 5	28 0	23 5	26 8	27 6	16 1	16 1	12 11
August	18 10	19 10	26 10	27 2	24 8	24 9	13 0	19 0	15 3
September	19 2	20 1	25 1	24 8	28 0	26 7	17 1	16 9	13 9
October	26 0	24 10	28 8	28 8	33 5	29 8	11 3	17 1	12 11
November	25 0	24 3	24 1	32 11	26 10	29 8	9 1	—	10 1
December	21 5	20 1	22 2	21 11	14 9	24 8	10 3	12 4	8 1
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 10	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

Season. (1st July to 30th June).	Eggs. Johannesburg. New Laid, per dozen.	Eggs. Johannesburg. Fresh, per dozen.	Eggs. Cape Town, per 100.	Eggs. Durban New Laid, per dozen.	Hides (per lb.). Port Elizabeth. 1st Grade, Sun-dried.	Hides (per lb.). Port Elizabeth. 1st Grade, Dry Salted.	Skins. Port Elizabeth. Merino. Medium, per lb.	Skins. Port Elizabeth. Merino. Combings, per lb.	Skins. Port Elizabeth. Glovers, Sound, per lb.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938–39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940–41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941–42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1941—									
January	1 1	0 9	9 3	1 3	5·9	6·3	4·7	7·3	3 1
February	1 4	1 0	9 2	1 7	5·7	5·9	4·4	8·2	3 1
March	1 8	1 3	11 10	1 10	5·4	5·8	5·0	8·9	3 2
April	2 1	1 7	13 8	2 6	6·3	6·9	6·2	9·1	3 5
May	1 11	1 6	15 8	2 7	6·5	6·8	6·3	8·7	4 0
June	1 8	1 5	14 9	2 0	6·5	6·8	6·1	8·6	4 3
July	1 6	1 4	14 0	1 10	6·3	6·8	4·3	7·8	4 2
August	1 0	0 11	8 9	1 1	6·5	6·6	4·4	8·0	4 2
September	1 0	0 11	8 5	1 1	6·5	6·8	4·4	8·1	4 1
October	1 0	0 11	8 10	1 2	6·8	7·0	3·8	7·7	4 0
November	1 1	1 0	9 1	1 4	7·0	7·1	4·3	7·7	4 1
December	1 5	1 2	9 10	1 9	7·3	7·3	4·0	7·8	4 2
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb. (a) Johannesburg. N.M. Prime.	(a) Johannesburg. Ordinary. Prime.	(a) Johannesburg. Good Medium.	(a) Johannesburg. Compounds.	(b) Durban. Medium.	(b) Durban. Compound.	Pigs per lb. Live Weight. Johannesburg. Porkers, Prime.	Johannesburg. Baconers, Prime.	Johannesburg. Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938–39	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940–41	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941–42	55 5	52 0	47 4	33 4	40 3	30 9	5·1	6·6	4·5
1941—									
January	45 7	42 11	39 6	34 7	32 2	27 7	4·8	5·7	4·0
February	45 0	41 2	38 1	32 9	29 11	24 5	4·3	6·2	4·1
March	40 6	38 3	35 5	29 7	27 11	21 4	4·2	6·1	3·6
April	42 4	39 10	36 3	30 1	29 10	25 5	4·2	5·6	3·8
May	44 6	40 8	36 10	30 9	29 4	22 1	4·2	5·6	3·9
June	43 9	41 2	37 6	32 8	32 2	25 9	4·3	5·4	3·7
July	46 5	44 5	39 10	33 5	34 6	29 11	4·6	5·6	4·0
August	47 0	44 9	41 2	33 7	35 5	29 3	4·5	5·6	3·5
September	49 11	47 1	44 2	36 11	41 9	33 11	4·8	5·6	3·7
October	56 5	53 6	50 1	44 11	46 1	34 8	5·0	5·6	4·2
November	68 4	63 2	55 5	42 8	51 4	36 4	5·5	6·2	4·8
December	72 2	68 7	60 3	43 0	49 2	33 6	5·4	6·4	4·9
1942—									
January	63 2	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
Oktober	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June to 31st May).	Johannesburg. Merino Wethers. Prime.	Merino Wethers. Medium.	Persians and Cross Breds. Prime.	Persians and Cross Breds. Medium.	Cape Town. Merinos. Prime.	Merinos. Medium.	Capes and Persians. Prime.	Capes and Persians. Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938–39	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940–41	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941–42	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1941—								
January	7·0	6·5	6·5	6·0	6·3	6·1	6·4	6·1
February	7·1	6·6	6·7	6·2	6·9	6·5	6·8	6·5
March	6·7	6·1	6·2	5·7	6·3	5·9	6·2	5·9
April	7·0	6·5	6·4	5·9	6·6	6·1	6·4	6·1
May	7·1	6·5	6·6	6·0	6·0	5·8	6·3	6·0
June	7·1	6·6	6·6	6·1	6·3	5·9	6·5	6·2
July	7·7	7·0	7·2	6·6	7·0	6·7	6·9	6·6
August	7·6	7·0	7·1	6·5	7·1	6·7	6·8	6·6
September	8·2	7·6	7·7	7·0	7·2	6·8	7·2	6·9
October	7·4	6·7	7·0	6·3	6·6	6·4	6·8	6·6
November	7·4	6·8	6·9	6·3	6·8	6·5	6·9	6·6
December	8·2	7·4	7·6	6·8	6·8	6·5	6·8	6·5
1942—								
January	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March	9·6	8·4	8·8	7·9	9·6	8·8	9·3	8·8
April	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
Oktober	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6

* As sold on the hoof. Reported by Meat Control Board.

G.P.-S.6691—1942-3—200.

CONTENTS

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[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Information on Departmental Publications.

Farming in South Africa, the monthly journal of the Department, contains popular as well as scientific articles on a variety of agricultural topics, useful to both the farmer and the housewife, while the **Crops and Markets** Section, supplies information on crop prospects, market prices and exports of agricultural produce.

The following particulars in regard to subscriptions and advertisements should be noted:—

Subscription.—Within the Union, South West Africa, Bechuanaland Protectorate, Southern Rhodesia, Swaziland, Basutoland, Mocambique, Angola, Belgian Congo, and British Territories in Africa 5s. (otherwise 7s. 6d.) per annum, post free, payable in advance.

Applications, with subscriptions, to be sent to the Government Printer, Koch Street, Pretoria.

Advertisements.—*The Tariff for Classified Advertisements is:* 2d. (two pence) a word with a minimum of 5s. per advertisement (prepaid). Repeats, not entailing any change in the wording, will be published at half the cost of the original.

Conditions:—

(1) The advertisement will be classified under specific headings, and only one black letter (initial letter) is permitted.

(2) Advertisements in which prices are mentioned must contain the name and address of the advertiser. A nom-de-plume or box number only is not sufficient, and unless this condition is strictly observed advertisements will not be accepted.

(3) Advertisements will be classified strictly in accordance with the subject-matter of the announcement, determined by the first item mentioned, and cannot be inserted under irrelevant headings.

(4) Displayed, classified advertisements will also be accepted. The charge however, will be 15s. per inch, single column, per insertion, without reduction for repeats.

Copy for Advertisements to be in the hands of the Government Printer, Pretoria, not later than the 20th of the month preceding publication.

Send all advertisements direct to the Government Printer, or write to him for details as to tariff for advertisements.

Popular Bulletins.—Bulletins on various agricultural topics are published by the Department to meet public demand. A list of available bulletins giving particulars of cost, etc., is obtainable free of charge from the Editor, Department of Agriculture and Forestry, Pretoria.

Scientific Publications.—From time to time the different Divisions of the Department issue science bulletins incorporating the results of research work conducted by them. Other scientific publications issued are: "The Onderstepoort Journal", "Memoirs of the Botanical Survey of South Africa", "Bothalia", "Entomological Memoirs" and the "Annual Reports of the Low Temperature Research Institute". Information in regard to these publications is obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Press Service.—The Press of South Africa is now supplied with a bulletin of agricultural information for their exclusive use. This information is published fortnightly by all newspapers and other journals throughout the country.

Farmer's Radio Service.—In addition to the printed information supplied by the Department to members of the farming community, the Department, in collaboration with the South African Broadcasting Corporation, also maintains a daily broadcasting service to farmers. Information in regard to times of broadcasting is contained in the programmes issued by the Broadcasting Corporation.

Inquiries.—All general inquiries in regard to the publications of the Department, including the Radio Service, should be addressed to the Editor, Department of Agriculture and Forestry, Pretoria.

D. J. SEYMORE, Editor

FARMING IN SOUTH ... AFRICA

Vol. 18 FEBRUARY 1943 No. 203

Editorial:

Cattle Farming and Research.

In the December, 1938, issue of *Farming in South Africa* mention was made in the report of the Division of Animal and Crop Production of an investigation into the problem of breeding cattle in tropical and sub-tropical areas, and areas with an unreliable rainfall. Possible lines of research were also indicated.

It had long been known that under unfavourable conditions the indigenous breeds possessed greater adaptability than the British beef breeds, but, except for general observations, there were few actual data to support this opinion. In 1937, long deferred facilities were created for animal-husbandry research. Since that time several articles have been published which have analysed more carefully the reactions of the various breeds and their crosses, that is, in so far as their measurable reactions like temperature, pulse, respiration, loss of drivel, etc., are concerned. In this issue there appears a further article which attempts to indicate how certain external characteristics of cattle, as for example, the colour and quality of the coat and hair, affect the adaptability of the animal under a given set of environmental factors.

In the past, improvements effected in characteristics connected with the growth, production, weight and quality of cattle, were made possible largely by improving their environment. The breeding of high-producing cows, for example, became possible only after the introduction of improved methods of feeding, management and housing.

In the more extensive forms of cattle ranching, environmental factors often make the large-scale provision of feed impossible. Apart from this, however, climate plays such an important rôle that due account must be taken of this limiting factor.

It is clear from the foregoing, therefore, that where the environment cannot be changed economically, and where unfavourable climatic factors cannot be eliminated, the only effective policy which the farmer can adopt is to breed animals which possess sufficient adaptability to enable them to grow, produce and reproduce in such an environment.

The whole process of life, i.e. growth, development and reproduction of animals, involves the closest interaction between an animal and its environment. It is only through the proper adaptation of an animal to its environment, or, provided this can be done economically, through the artificial modification of the environment to meet the requirements of the animal that the stock farmer can increase economic production to its maximum capacity.

With this end in view, the Division of Animal and Crop Production has, in its efforts to give concrete assistance to the cattle breeder in his selective breeding activities in the warm-temperate areas, been engaged since 1937 on the careful investigation of the interaction between the animal and that environmental factor, climate, as well as a determination of those factors which promote adaptability.

The aim is to breed, for those areas, animals which will be able to exist and thrive in the environment in which they find themselves,

If these and similar articles published by officers of the Division are able to give the cattle farmer guidance in his selective breeding, this Division, which is responsible for matters of policy in regard to animal husbandry, will feel that it has made a contribution not only to science but more particularly to the practical application of methods designed to promote stock-breeding in this country. The work done in this connection at the Mara Experiment Station will be published from time to time.

(Prof. A. M. Bosman, Director of Animal and Crop Production.)

Danger of selling Breeding Ewes as Slaughter Stock.

WAR conditions have created an abnormally large demand for all types of slaughter stock, and exceptionally high prices are being offered. In view of the attractive prices, farmers are tempted to sell as many of their animals as possible, whereas in the past it was the practice for sheep-farmers annually to market a certain number of hamels and culled ewes only, it is now being observed that at stock sales considerable numbers of young breeding ewes are being offered for sale as slaughter stock.

In this connection, a timely warning to farmers is necessary. Sending large numbers of breeding stock to the abattoirs may cause a rapid decrease in our sheep population and, if not checked in time, may cause a depletion from which, the sheep industry will not recover for many years. After the drought of 1933 it required about eight years to raise the sheep population of the Union to its pre-drought level again. Already large numbers of breeding stock have been lost during the dry winter of 1942 and the subsequent cold and rainy months of September and October, and if in addition, large numbers of breeding stock are now sold for slaughter, the position may soon become critical. Re-establishing the sheep industry will be a slow and costly process.

Thus, before deciding to market any breeding ewes for slaughter purposes, the farmer should carefully consider the following factors:—

1. If the farm already carries the optimum number of stock, the safest policy would be to maintain that number and replace the older ewes by young ewes of better quality.

2. If the numbers of stock are still below the normal carrying capacity of the farm, the safest and, in the long run, most economical policy would be to continue breeding until this figure is reached, before selling any useful breeding ewes.

3. On the other hand, farmers should not be encouraged by the favourable wool prices to keep too many sheep.

Those who have in the past, allowed their farms to be too overgrazed, and there are many of them—now have a golden opportunity of disposing of surplus stock at profitable prices and placing their sheep-farming on a sound footing. Keeping just the correct number of sheep will in the end pay the farmer best. *Overgrazing is false economy.* Overgrazed for a few successive years, results in such serious damage to the vegetal covering of the veld that it sometimes requires a lifetime or more to restore it, and even then only at considerable expense.

Instead of luring sheep farmers into a trap, the prevailing high prices should, therefore, induce farmers to place their concerns on a sound basis.

(H. C. Bonsma and D. J. Engela, Sheep and Wool Research Officers, Grootfontein College of Agriculture.)

The Phases of the Lesser Army Worm.
[*Laphygma exigua* (Hübn.).]

J. C. Faure, Professor of Entomology, University of Pretoria.

THE theory of phases in migratory locusts, proposed about twenty-two years ago by Uvarov (1921), is now accepted by most authorities as a doctrine that has been thoroughly tested and proved to be correct in field observations as well as laboratory experiments (Faure 1932). The main points in the theory may be briefly summarized as follows:—

1. Locust flyers and hoppers occurring in large swarms or bands are nearly uniform in size, shape and colour; when the swarms or bands have disappeared, the insects living as solitary individuals assume an entirely different appearance, and the hoppers display a variety of colours. These differences are so great that laymen, and even some scientists, find it difficult to believe that the two phases belong to one and the same species.

2. The hoppers of the solitary phase are usually green or gray, whereas those of the swarming phase display a striking coloration, usually black and orange or reddish brown.

3. The adults of the two phases differ in structure: the flyers of the swarming phase have wings relatively longer than those of the solitary phase, and other measurable differences have also been found.

4. The phases also differ in habits and in rate of development; the locusts of the swarming phase form large swarms which migrate long distances, but those of the solitary phase live as scattered individuals which do not migrate to any extent, at least in the case of the brown locust. For the brown locust, Smit (1939) has shown that phase *solitaria* completes the hopper development in 25 days, whereas phase *gregaria*, the swarming phase, takes about 40 days.

5. Whereas the locusts of phase *gregaria* spread over a vast area during swarming cycles, those of phase *solitaria* can live permanently only in comparatively small areas known as the outbreak areas. After a swarming cycle has come to an end, new swarms can only arise from phase *solitaria* in the outbreak areas.

The phase theory is undoubtedly of great practical importance in the study and control of migratory locusts. Anyone who wants to study the life history and development of a given species of locust in the field should be able to recognise it in its solitary phase. Since the species assumes the solitary phase during the periods when there are no swarms, and since new swarms arise from the solitary phase, it follows that it is of the utmost importance to study the behaviour, development and ecological requirements of phase *solitaria* in great detail, both in the field and in the laboratory, in order to understand the factors which favour the formation of new swarms. The modern idea in locust control is to find the outbreak areas, and to endeavour to control the locust in these areas before huge swarms are formed (Uvarov, 1[illegible]

As far as the writer has been able to a[illegible] ses have thus far only been found to occur in locusts a[illegible] s, and there is some evidence that they probably also o[illegible] horned grasshoppers (Tettigoniidae). All these inse[illegible] o the order Orthoptera, of which locusts, grasshoppers [illegible] cockroaches are familiar examples. There appear to [illegible] nces in the

published literature* to the discovery of phases in any other group of insects.

It is therefore a matter of considerable theoretical and practical interest and importance to record that phases have been found to occur in the lesser army worm, *Laphygma exigua* (Hübn.), in the writer's breeding experiments, which are discussed in this paper.

The important South African army worm, which caused widespread losses in the summer of 1941-42, is *Laphygma exempta* (Walk.). Of this species the writer was unable to obtain living material during the period August to December 1942. Therefore only *L. exigua* was used in the breeding experiments discussed in this paper. This species is of much less importance as a pest in the Union of South Africa than *L. exempta*, the true army worm. *L. exigua* is a pest of importance in Asia Minor, Morocco and Portugal on sugar beets, maize, peas, and various other crops.

The writer is greatly indebted to Mr. E. E. Anderssen, of the Division of Entomology, for living material of *L. exigua*, and to Professor A. J. T. Janse for the identification of the species dealt with in this paper.

Breeding Experiments: Technique.

Three generations of *L. exigua* were bred in the laboratory from October to December 1942, in a room in which the temperature was kept constant, at about 85° F., and in which the relative humidity was also maintained at about 60-70 per cent. They remained in this room throughout the day and night, except for about three hours during the morning when they were transferred to rooms with ordinary room temperature for feeding, cleaning of the containers and examination.

During the periods of larval development strong electric lights were kept on during the day and the night. While moths were present the lights were usually turned off; but since there was some overlapping of larval development and adult activity, it was not possible to keep the larvae in the light and the moths in darkness at all times. Great care was taken to subject the larvae reared in isolation and those reared in crowds to identical conditions: the various parallel series were removed from the warm room, and returned to it simultaneously.

Larvae reared in isolation were kept in glass specimen tubes, about four inches by one inch, closed by means of cotton wool stoppers; the tubes were kept in the horizontal position in shallow trays or baskets. Only one larva was placed in each tube. When the larvae became full grown soil was placed in each tube for pupation, the tube was put in the vertical position, and the cotton wool was replaced by a cloth cover.

For the crowds the same 4 in. by 1 in. tubes were used for the first ~~few~~ days; then the larvae were transferred to glass cylinders 5 in. by 2 in., the two open ends of which were covered with cloth. For very young larvae a densely-woven cloth was used but from the second instar onwards a more airy muslin cloth was employed. When the 5 in. [...] linders seemed to be too small, the crowds were transferre[...] lamp chimneys, 12 inches high, 5 inches wide at the wi[...] nd about 2½ inches wide at the top. These

*The followi[...] occurs in the roneod monthly report of the Division of Ent[...] the Department of Agriculture and Forestry, Pretoria, for Ma[...] 1942: "*Lepidoptera* (Munro). Army worm: locally there were [...] larvae in scattered (solitary) formation, typical moths were bred [...]'.

were also covered with cloth. Both the cylinders and the lamp-chimneys were kept in the horizontal position. Finally some of the crowds were placed in metal dishes, about 11 in. by 7 in. by 3 in., and these were put in cages of wood, cloth and glass; the metal dishes were only used towards the end of the larval development.

Young growing maize, usually seedlings about 3 to 6 inches high, was used throughout all the experiments as food for the larvae. Fresh food was supplied once a day, but in the case of the crowds additional food had to be given once or twice a day, since the containers were too small to hold a supply sufficient for 24 hours. Special care was taken to give exactly the same kind of food to the larvae reared in isolation and those kept in crowds. Soil was provided for pupation, and it was kept moist. The moths were confined in cages, about 16 in. by 14 in. by 9 in., made of wood, glass and cloth; sugar water was placed in each cage, and a young maize plant, standing in water. No accurate records were kept on this point, but the impression was gained that most of the eggs were deposited on the plants.

Two crowds were also reared outdoors on young growing maize plants in cloth-covered cages. The results obtained were similar to those obtained in the laboratory, as far as the colours developing in crowds are concerned.

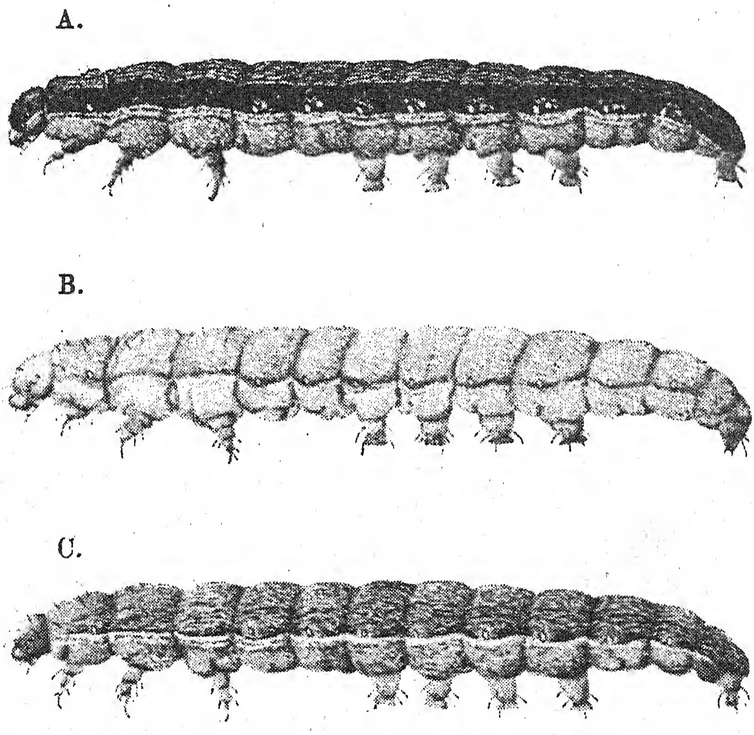

FIG. 1.—Larvae of *L. exigua* in fifth instar, all of the second generation, about four times natural size:—

A.—Larva of phase *gregaria*, type "A", reared in a crowd.
B.—Larva of phase *solitaria*, green, with pink markings on substigmatal stripe; reared in isolation.
C.—Larva of phase *solitaria*, dark pinkish grey, reared in isolation.

From drawings in natural colours by Miss K. Howitson.

Life-history.

Under the laboratory conditions described in the preceding section the developmental periods of the various stages of *L. exigua* were: egg stage about 2 days; larval development for the five instars combined about 10-11 days; prepupal and pupal stages combined about 6-8 days. The first eggs were laid about 2-5 days after the emergence of the moths; the moths lived for about 8-10 days.

Effects of Crowding and Isolation.

As is shown in table 1, a total of 606 larvae were reared in isolation in the three successive generations. About 88 per cent. of these were pale green, dark green, yellowish or pale grey in the fifth stage (fig. 1B) and classified as *solitaria;* the remaining 12 per cent. were described as dark grey (similar to fig. 1C) or very dark grey and regarded as *transiens*. In the *transiens* group 14 larvae, or about 2 per cent. of the total number reared in isolation, had distinct and more or less continuous black supra-stigmatal stripes similar to those of type " C " of the crowds, described below.

Altogether 5,674 larvae were reared in 39 crowds in the three generations. About 92 per cent. of these larvae were strikingly darker than the great majority of those reared in isolation, i.e., much darker than the pale green, green and pale grey *solitaria* larvae referred to in the preceding paragraph. The remaining 8 per cent. were similar in general coloration to the *solitaria* larvae reared in isolation.

TABLE 1.—*Coloration of larvae of* L. exigua *reared in crowds and in isolation.*

REARED IN CROWDS.

Generation Number.	Number of Crowds.	Total Number Larvae in all Crowds.	Census based on Coloration: Average Percentage.		
			Gregaria.	*Transiens.*	*Solitaria.*
1................	8	304	62·2	17·4	20·4
2................	22	3,782	66·9	26·7	6·4
3................	9	1,588	58·9	30·7	10·4
TOTAL: Three generations..	39	5,674	64·4	27·3	8·3

REARED IN ISOLATION.

Generation Number.	Total Number of Larvae.	Census based on Coloration: Percentage.		
		Gregaria.	*Transiens.*	*Solitaria.*
1..............................	115	0	13·9	86·1
2..............................	257	0	15·5	84·5
3..............................	234	0	7·3	92·7
TOTAL: Three generations...	606	0	12·0	88·0

When a considerable percentage of the larvae in the crowds had reached the fifth instar, all the individuals in the crowd were

carefully examined and classified on the basis of their coloration into one of six groups, which may be briefly described as follows:—

A. Largely velvety black; head almost wholly black, supra-stigmatal stripes nearly solid velvety black, narrow sub-stigmatal stripes just below them strikingly conspicuous, yellow and pink or greyish; a narrow velvety black stripe on middorsal line, the broad stripes on each side of it very dark, almost black in some individuals, usually with very fine wavy longitudinal lines and spots that are green, yellowish-pink or white; ventro-lateral aspect grey-green to pink, mottled with paler yellow or white specks, much darker in some individuals, legs and prolegs sometimes almost black. Fig. 1A represents the "A" type of coloration, but the strong contrast between the pale sub-stigmatal stripe and the black supra-stigmatal stripe is not shown satisfactorily.

B. Very similar to "A" but somewhat less black, supra-stigmatal band not such a solid velvety black; the two broad dorsal stripes paler than in "A", more distinctly green, with fine longitudinal wavy black and green or grey lines, pink in some individuals.

C. Somewhat paler than "B", head not solid black, supra-stigmatal stripes very well defined and continuous and distinctly black, sometimes even partly velvety black, but less solid black than in "B", sometimes greenish black; contrast between supra-stigmatal and sub-stigmatal stripes not so striking as in "B" or "A".

D. The head brown to greyish black, mottled in some larvae; the supra-stigmatal stripes fairly continuous and conspicuous as dark stripes in most larvae, somewhat broken in others; generally more green than "A", "B" and "C", and paler.

E. Paler than "D", heads yellowish to blackish grey, supra-stigmatal stripes not solid and continuous but usually more distinct than in the "pale green" type of larva reared in isolation, which is illustrated in fig. 1B.

F. Paler than "E", heads yellowish grey, general colour green, or yellow, usually darker than "pale green" larvae reared in isolation; supra-stigmatal stripes not conspicuous.

It should be noted that the coloration of the larvae is very variable, and that the above subdivision into six types could not be applied with a high degree of exactitude because the types grade into one another. Nevertheless, looking at 10 to 50 larvae in any group collectively one could see very clearly that they differed distinctly from those in the other groups.

The ideal would be to classify all larvae in the fifth instar only, but in practice this could not be attained, unless the census were spread over several days. Some larvae always reached the prepupal stage two to four or more days before others in the same crowd, so that the density of the crowd varied from day to day because some larvae entered the soil to pupate. It was, therefore, thought best to base the results on one census only, regardless of the fact that many individuals might still be in the fourth instar, while others were still in the third.

Another feature to be borne in mind is that the coloration of the larvae changes to a considerable extent in a period as short as one day, or even less. A larva in the middle of its fifth instar would be described as a good "A" type, with well-developed velvety black stripes; but after another day's feeding it looks swollen, and "greasy" black instead of velvety black.

Cannibalism caused a great and rapid reduction in the density of the population in the crowds, especially in the fourth and fifth instars. In several cases a complete census was taken at intervals of two days, and it was found that only about one-half of the larvae were present at the second census; this reduction was not due to pupation. For instance, on December 7th the crowd G.g. 48 was taken from a lamp chimney, 12 in. by 5 in.; there were 356 larvae of the 3rd to the fifth instars; they were placed in a metal dish 11 in. by 7 in. by 2½ in., and on December 9th only 184 larvae were found at the second census.

At the time of the census of the larvae in any given crowd, the parallel series of larvae reared in isolation were also examined individually and compared with those from the crowd.

The Characteristics of the Phases, based on the Coloration of the Larvae.

In table 1 the larvae have been grouped into three phases: *gregaria*, *transiens* and *solitaria;* groups "A", "B" and "C" described above were taken to represent *gregaria*, "D" was labelled *transiens*, and "E" and "F" were regarded as *solitaria*. In the case of the larvae reared in isolation, the pale green, green and pale grey types were regarded as *solitaria*, while the dark grey and very dark grey larvae were placed in *transiens*.

This classification into phases is not entirely satisfactory, if compared with that used by the writer (Faure, 1932) in the case of the South African migratory locusts. The *gregaria* type of *L. exigua* larvae is not uniform, there being a considerable difference between the extreme velvety black type "A" and the palest type of "C" larva. Nevertheless, the writer believes that the classification adopted is fully justifiable, and that he has, if anything, erred on the side of conservatism, it is possible that many of the "D" type larvae from crowds, classed as *transiens*, should rather have been included in *gregaria*.

Attempts to Intensify the Phase Characters.

In the first and second generations the "A" and "B" types of larvae were selected from the crowds in order to breed a "*gregaria* line", if possible. Similarly, the pale green, pale grey and dark grey types of larvae reared in isolation were selected for producing "*solitaria* lines". In the succeeding generations some of the progeny of all these lines were reared in crowds and others were reared in isolation. The results obtained may be summarized briefly as follows:—

1. The great majority of all larvae reared in isolation assumed the *solitaria* type of coloration, whether their parents (and in the third generation both parents and grandparents) were velvety black *gregaria*, or green *solitaria*, or dark grey *solitaria*.
2. In all crowds the great majority of larvae developed the *gregaria* coloration, regardless of whether the preceding one or two generations had been reared in isolation or in crowds.
3. No clear evidence was obtained of a carrying over of phase characteristics from one generation to the next. In the first two instars all larvae were pale green, even those of the third generation descended from velvety black parents and grandparents. This is in striking contrast to the position in *Locustana pardalina*, in which the first instar hoppers of *gregaria* are black, while those of phase *solitaria* are grey.

4. The general impression gained, was that the degree of development of *gregaria* characters in crowds depended upon the density of the crowd rather than upon the phase history of its parents. Owing to the technical difficulties involved, it was not found practicable to control the density of crowds with any degree of accuracy.

Larvae Reared on Black and White Backgrounds.

In migratory locusts it has been shown (Faure, 1932) that hoppers, reared in isolation on backgrounds of various colours, tend to take on a strong resemblance to certain colours. Seventeen larvae of *L. exigua* were reared in isolation in tubes covered with black paper and closed with black cotton wool; only a strip about $\frac{1}{8}$ inch wide was left uncovered on the upper side of the tube, for its full length, to admit light. Six of these larvae became black, and two of the six were described as velvety black, indistinguishable from the *gregaria* type reared in crowds. Six others were described as very dark, showing a fair degree of adaptation to the colour of the background. The remaining five larvae showed no adaptation to the colour of the background.

Twenty-two larvae were reared in isolation in tubes similarly covered with white paper. None of these became white; seven were pale green, and fifteen were dark green or grey. Since the larvae reared on white did not differ from those reared in plain glass tubes, there is no indication that their coloration was modified by the white background. In all the experiments the plain glass tubes were kept in baskets and on trays of a dull greyish or yellowish colour.

In rearing larvae of army worms in the laboratory, with a view to studying their phase characteristics or other colour characters, it seems desirable to keep them in light, at least for a part of each day, since they might assume dark colours if reared in complete darkness. In any case the possible effects of light and darkness should be studied. The writer did not study the effects of rearing larvae in complete darkness, but the development of *gregaria* characters in crowds could not be ascribed to the effects of light and darkness, for these reasons: (*a*) It is well known that various species of army worms develop a deep black coloration when occurring in crowds in nature. (*b*) The crowded and isolated larvae were kept side by side in the same room and subjected to the same light in the writers breeding experiments.

Morphological and Physiological Differences.

Since migratory locusts develop striking morphological and physiological differences in their various phases, the possibility of similar differences occuring in army worms should also be borne in mind. The adults of *L. exigua* reared by the writer from larvae which developed in crowds were slightly darker on the forewings than those reared from larvae kept in isolation; this difference was not very striking, and in order to see it one should compare groups of ten or twenty adults, rather than single individuals.

No differences have been found in the size, wing-length or other structural characters of the adults of the phases in *L. exigua*. The genitalia have not been examined.

Since the mandibles of *L. exigua* have sharp teeth and those of *L. exempta* are blunt (Hattingh, 1941), the writer compared the mandibles of 5 to 12 larvae from each of 7 crowds with those of 25 larvae reared in isolation. The mandibles of about a dozen

exuviae of fifth stage larvae from crowds were also compared with those of about twenty larvae reared in isolation. The mandibles were found to vary in the sharpness of the teeth, but no difference could be found between *solitaria* and *gregaria*. The teeth on the exuviae of the mandibles are generally more blunt than those on the larvae in the fifth instar. This is probably the result of biting on soil particles during the construction of the cocoon.

As regards physiological differences, the general impression was that the *gregaria* line did not develop quite as rapidly as the *solitaria* line. There was some indication that the prepupal plus pupal stage, and the pre-oviposition period might be slightly longer in *gregaria* than in *solitaria*. But no conclusions can be drawn on these points from the writer's experiments, because they were not carried out with sufficient attention to detail, and they were not designed to yield accurate data on the duration of the developmental periods. For instance, the *gregaria* larvae were not isolated at the time of pupation in order to determine accurately the duration of the pupal stage; nor was the amount of water added to the soil during pupation carefully measured and recorded.

Conclusion.

The results of the breeding experiments, discussed above, warrant the conclusion that phases occur in *L. exigua*, although the phase differences are not as pronounced, especially in adults, as they are in migratory locusts. In locusts one could easily obtain about 99 per cent. *gregaria* hoppers in crowds after two generations of crowding, but in *L. exigua* the average percentage of *gregaria* larvae was only 64.4 per cent. The highest percentage of *gregaria* was about 91 per cent. found in three crowds, and the lowest was about 28 per cent., noted in two crowds. These figures for *gregaria* include the " A ", " B " and " C " types of larvae. If only the velvety black larvae of groups " A " and " B " were to be regarded as *gregaria* the average percentage would be much lower, about 26 per cent.

In South Africa *L. exigua* does not cause such severe outbreaks as those of *L. exempta*, the true army worm. It is possible that the phase differences may be found to develop to a greater degree in *L. exempta*, although this seems doubtful, since the larvae of the first two instars are green in colour in outbreak seasons such as 1941-42 (see the illustrations in Hattingh's paper, 1941).

As in the case of locusts, the great difference between life in a crowd and life in isolation is that the larva in the crowd is far more active. Activity probably leads to the production of an excess of waste products which in turn leads to the formation of the black coloration. Since *L. exigua* undergoes complete metamorphosis, with a quiescent pupal stage of about seven days after the larval stage of about ten days (in the laboratory), it is perhaps not surprising that there appears to be little if any carrying over of externally visible phase characters to the adult stage or to the next generation. In migratory locusts there is no resting stage between the last nymphal instar and the adult, therefore there appears to be no opportunity for the organism to get rid of the excess of waste products accumulated during the nymphal development. But in *L. exigua* the pupal stage appears to provide this opportunity.

If further researches confirm the writer's tentative conclusion that the phase differences which develop in army worm larvae are to a large extent lost again during the pupal stage, this would

support the theory that phase differences are due to muscular activity and the accumulation of an excess of waste products, which cannot be eliminated by the organism.

On the other hand, the egg-stage of *Locustana pardalina* is probably as much a resting stage as the pupal stage of *L. exigua*, but in the former the phase characters are not lost, although the egg-stage may be as long as six to twelve months, or longer, as compared with the hopper development of 40 days. Possibly the explanation may be that the mature larva and pupa of *L. exigua* are able to get rid of excess waste products, whereas the embryo of *L. pardalina*, being unable to do so, deposits its excess of waste products in the form of black pigment in the cuticula. Adult *Lepidoptera* pass several large drops of liquid excrement, the meconium, soon after emerging from the pupal case. This has not been observed in newly-hatched locust nymphs; their alimentary canal contains the yolk of the egg, which serves as food during the first 6-18 hours after hatching.

Although no striking phase differences in colour or structure have been found in the moths of *L. exigua*, this does not necessarily mean that there are no physiological differences between the phases in the adult stage, and this aspect of the problem deserves further study. Williams (1930) states that *L. exigua* is known to be a migrant. Since migration is one of the outstanding characteristics of the phase *gregaria* in locusts, it seems practically certain that migration is also directly connected with the gregarious phase in army worms.

Practical Importance.

It is generally agreed that a detailed knowledge of all aspects of the biology of an insect pest is essential to one who would devise satisfactory measures for its control. Therefore anyone studying the biology of an army worm should be able to recognize its larvae in the solitary phase. If the parallel between phases in army worms and in locusts is valid for other aspects besides larval coloration, it seems very probable that army worms will also be found to have different ecological requirements in their different phases. That is to say, they will also be able to live permanently in the phase *solitaria* only in comparatively small outbreak areas, in which swarms arise from the solitary phase under conditions that are favourable for rapid multiplication.* And if this is so, the species of army worms which produce sudden severe outbreaks will almost certainly be found to migrate over long distances in the adult stage.

There are many references in the literature to the migration of the adults of army worms and other injurious species of Noctuidae such as the cutworm, *Agrotis ypsilon*, the American cotton worm *Alabama argillacea*, the European sugar beet pest *Plusia gamma*, and the American cotton bollworm, *Heliothis obsoleta* (see Williams 1930).

In the case of the South African army worm *Laphygma exempta*, Lounsbury (1919) came to the conclusion that the species migrates, from a study of the sequence of the dates on which, and the localities from which, outbreaks were reported. Hattingh (1941) did not accept the theory of migration, but the arguments which he advanced against it are not convincing in the opinion of the present

*Acording to Hattingh (1941), it was suggested by Dr. T. J. Naudé in 1936 that outbreaks of *L. exempta* might originate in certain hypothetical areas, called "optimum habitats".

writer. Apart from the phase theory, the strongest points in favour of the theory of migration are:—

1. The species cannot hibernate in any of its developmental stages. It seems, therefore, impossible that it could breed continuously on the bleak, cold high veld during the winter months, and during dry periods in the early summer, when there is practically no green grass at all.

2. Outbreaks are first reported from the low veld, i.e., the tropical and subtropical areas, and afterwards from the cooler high veld areas. Hattingh states that he found small outbreaks on the high veld before outbreaks were reported from, or before large outbreaks eventuated on the high veld, and concludes from this that these small early infestations arose from locally bred army worms. But in the present writer's opinion this is no proof that migration did not occur, since moths could easily arrive in small numbers, after being carried upwards in convection air currents. Hattingh states that the larvae from three of these small unreported outbreak areas were of the same age as those from the outbreak which had been reported from Tzaneen, and assumes that this proves that the high veld outbreaks were of local origin. Obviously this similarity in the age of the larvae is a strong argument in favour of migration of moths from a common source!

3. The tendency of the adults to congregate in large numbers, which is accepted by Hattingh as a well-established fact.

The problem of the origin of the severe outbreaks of *L. exempta*, which occur at irregular intervals in South Africa, deserves further detailed study. Some of the most important points that should be settled are whether the species develops phases or not, where its permanent breeding grounds are located, and whether there is any possibility of controlling outbreaks at their source in the permanent breeding grounds.

The fact that phases have been found to occur in *L. exigua* strongly suggests that they may also occur in other members of the order Lepidoptera, and possibly in Coleoptera as well, especially in the case of leaf-feeding larvae which migrate up and down tree trunks or over the soil in severe outbreaks. Even if no striking phase differences in the colour of larvae, or the structure of adults can be demonstrated, the possibility should not be overlooked that physiological and ecological phase differences may exist.

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New Conditions and the Agricultural Industry.

Report of the Department of Agriculture and Forestry and Food Control Organization for the Year Ended 31 August, 1942.

Dr. P. R. Viljoen, Secretary for Agriculture and Forestry and Deputy-Controller of Food Supplies.

III. The Position of the Other Agricultural Products.

APART from those food products which have already been dealt with and which, at the moment, are of more than usual importance, there are naturally several other products which also play a prominent rôle in our national economy. Their economic position during the past year must, therefore, also be briefly indicated.

Wool.

During the wool season 1941-42 approximately 237 million lb. of wool were produced in the Union alone and appraised by the British Wool Commission at prices with which most wool farmers were satisfied. On the whole, the quality of this Union clip was good, and compared quite favourably with that of the previous season, while the various clips were, generally speaking, also well classed.

Chapters I and II of this report appeared in last month's issue (January) and give a general review of matters pertaining to agriculture under wartime conditions, as well as the activities of the Food Control Organization.

Although prices under the Wool Agreement have been highly satisfactory during the past few war years, the Government nevertheless felt that, in view of the rising costs of production and the increased living costs of the farmer, it was necessary that an effort should be made to improve the contract price. The High Commissioner for the Union in London was, therefore, instructed to make representations in this direction to the British Government. In the meanwhile the Australian Government also took up the question of wool prices and the British Government consequently decided to increase the price of wool to Australia by 15 per cent., and at the same time declared its willingness to make a similar adjustment in regard to South African Wool prices. The negotiations entered into as a result of this announcement led to the adoption of a new price schedule which embodied these increases and replaced the old price schedule as from 1 July, 1942. It should be pointed out that in the new schedule the price relationship between the different types has

not been changed but that the same percentage increase has been applied to all the types.

The increased prices which wool farmers will obtain during the wool season 1942-43 should compare very favourably with the prices of other agricultural products and enable them to show a reasonable net profit. This profit should be applied towards reducing financial burdens since the increased price of wool in itself unfortunately carries an unhealthy and dangerous germ which may possibly make its harmful effect felt after the war.

As a textile fibre, wool must compete with various artificial fibres, the prices of which were and still are considerably lower, and after the war this competition will in all probability be even keener than it was before or during the war since the production technique of artificial fibres is undoubtedly being improved to-day in all the textile manufacturing countries, especially on the continent of Europe. After the war the wool industry will probably have to reckon with an improved artificial fibre the price of which is much lower than that of wool, possible surplus stocks of unmanufactured wool in England, Australia and the Union, and a low purchasing power on the part of the consumers of textile articles.

Mohair.

The Mohair Advance Scheme, which had been in operation during the previous season, was again made applicable to the summer and winter mohair clips of 1942, with one exception, however, namely, that, if a mohair farmer wishes to avail himself of the facilities offered under the scheme, he must pledge his whole clip to the Government. Previously he could apply for an advance on single types of his clip and then pledge only those types to the Government. No applications for advances were received, however.

Generally, the different types were disposed of at satisfactory prices. Consequently, almost the entire clip was sold. Of the 10,479 bales received at the ports during the season, only 1,186 bales remained unsold at the end of June, 1942, as against 1,811 bales at the end of June, 1941.

Hides and Skins.

Except towards the end of the report year, firm prices were maintained for all classes of hides and skins. During the past few months, however, the ruling prices for skins were not so strong. By far the greater part of the exports went to Great Britian and the United States of America. The latter country took more of our hides and skins than ever before. In spite of the increased consumption in the Union, the total quantity exported was almost equal to that of the pre-war years.

As a result of the large contracts for army boots, the local demand for wet-salted hides reached unprecedented levels. The export of this class of hide is prohibited and even dry-salted hides of 30 lb. or more may not be exported.

Unfortunately, pit-salting is still practised on a considerable scale and until this undesirable method of treatment is completely eliminated, we cannot expect good hides and a sound trade. The standard of treating hides and skins also leaves much to be desired, and it is felt that until such time as the internal marketing of the industry is organized in such a manner that production for quality is encouraged more directly, no appreciable improvement in this respect is likely to be effected.

During the past year the Hides and Skins Advisory Board once again devoted attention to the interests of the industry and concerned itself mainly with matters relating to price control, internal marketing and exportation.

Tobacco.

The tobacco crop for 1942-43 is estimated at 25,200,000 lb. which represents an increase of approximately 2,200,000 lb. on that of the previous year. This indicates that from the production point of view, the tobacco industry once again did not have an exceptionally good year. The drought is largely responsible for this.

In so far as the manufacturing side is concerned, considerable progress was again made and the stimulating effect of the war on the consumption of tobacco, particularly in the form of cigarettes, continued to manifest itself. There was, in consequence, a substantial increase in the quantity of tobacco processed. Whereas this amounted to approximately 25,000,000 lb. in 1940, the quantity was almost 29,000,000 lb. in 1941. In view of the increase in the consumption and exportation of Union tobacco products, a total duty-free quota of 3,000,000 lb. Virginia tobacco from Southern Rhodesia was fixed for the season ended 31 May, 1942. This does not include the annual quota of 400,000 lb. from Northern Rhodesia. For the current season a preliminary quota of 1,000,000 lb. of Virginia tobacco from Southern Rhodesia was fixed. This will be increased according as the export of processed light tobacco products exceeds that of the previous year.

Tobacco prices were good. In 1939 basic prices were fixed for tobacco. For the 1940 crop these basic prices were increased by 15 per cent. in the case of flue-cured and light air-cured tobacco, and by 7½ per cent. in the case of dark air-cured tobacco. The prices remained unchanged for the 1941 crop, except that the price for light air-cured tobacco was increased by a further 7½ per cent. The prices for the 1942 crops, i.e. the crop marketed after 1 April, were fixed as follows.—

Flue-cured tobacco: basic price plus 20 per cent.
Light air-cured tobacco: basic price plus 22½ per cent.
Dark air-cured tobacco: basic price plus 15 per cent.

As regards flue-cured and dark air-cured tobacco, there were, therefore, further improvements on the prices of the previous year, and there is no doubt that, on the whole, tobacco producers obtained quite satisfactory prices.

Citrus Fruit.

Owing to the fact that shipping space for citrus fruit was very limited during the 1941 season and that it was no more than reasonable to let all exporters share in what export there was, the Citrus Control Board was given full control under War Measure No. 15 of 1941 over both the export and sale on the local market of all citrus fruit of exporters. Provision was also made for the proceeds to be paid into a pool from which the Board then makes equal "per box" payments to all exporters.

The British Ministry of Food increased the 1940 seasonal prices for South African oranges from 18s. 9d. per box with a count of 126 or less and 19s. 6d. per box with a count of 150 and higher to 22s. 7d. and 23s. 6d. per box, respectively, for the 1941 season .The latter prices secured for the industry the favourable average free-on-board price of approximately 12s. 9½d. per box. Unfortunately, however, only 38 per cent. of the orange export crop could be ex-

ported at these favourable prices. No other kinds of citrus fruit were exported.

The greater part of the export crop had, therefore, to be sold on the local market by the Citrus Board. In order to improve marketing, local grading regulations were promulgated during 1941. The regulations are applicable to the eight most important municipal markets in the country. During the 1941 season the Citrus Board disposed of approximately 5,850,000 pockets of citrus fruit on the local market. For the season as a whole an average price of 1s. 10½d. per pocket was realised on the markets.

With a view to encouraging the local consumption of citrus fruit, the Citrus Board last year instituted a scheme under which, in co-operation with the Department of Social Welfare, oranges are made available at lower tariffs to charitable institutions, schools, hospitals, etc. The applications are considered by the local social welfare officers, who submit the applications together with the money to the Citrus Board. The prices under the scheme are 3s. per sugar pocket and 1s. 3d. per orange pocket. The railage is paid by the Department of Social Welfare. The scheme was in operation in respect of both the 1941 and 1942 seasons.

Out of the total proceeds from exported fruit and fruit sold on the local market, the pool was able to pay a net price of approximately 3s. 6d. a box to exporters. That is to say, exporters obtained an average price of 3s. 6d. per box under the tree for all their fruit (of export quality as well as that which was suitable only for the local market). Four boxes of non-export quality, however, were regarded as equal to one box of export quality. This price compares very favourably with pre-war prices.

Since, as a result of the war, credit facilities could not be made available along the normal channels, exporters were financed largely by the Citrus Board in the production and packing of their fruit. For this purpose the Citrus Board negotiated a loan of £700,000 with the Land Bank which was guarenteed by the Government. The loan was repaid out of the pool funds.

In so far as the 1942 season is concerned, the Citrus Board has again been given full control over all the citrus fruit of exporters, both as regards export and sale on the local market and, as was the case in 1941, a pool is also being managed by the Board. It would seem that it will again be possible to export a considerable portion of the crop. The demand on the local market is also good and prices are better than those of last year.

Deciduous Fruit.

Like last year, it was again impossible to export deciduous fruit to Great Britian. The whole export crop had therefore to be absorbed locally, and in order to keep the industry going, it was necessary once again to assure minimum prices to deciduous-fruit farmers.

Under War Measure No. 52 of 1941 it was laid down that producers of plums and pears in the export districts of the Cape Province had to deliver all their fruit to the Deciduous Fruit Board at fixed tariffs. Exporters of grapes, peaches and apples could, if they so desired, deliver only the export portion of their fruit to the Deciduous Fruit Board. The fruit growers are then paid the fixed prices out of funds which are made available to the Board by the Land Bank under a Government guarantee. These prices, although lower than the average pre-war export prices, are calculated to keep the industry on its feet.

The Deciduous Fruit Board markets the maximum possible quantity of fresh fruit on the local markets. The total production, however, is far too great for local consumption and it is therefore essential to convert into wine, to dry, or to sell to canning factories a large proportion of the fruit taken in. To that end the Board has erected the necessary drying yards and wineries. Despite the keenest efforts of the Board in regard to sale on the local market, there was nevertheless a deficit of approximately £240,000 which had to be made good by the Treasury.

Often the complaint is heard that in spite of the large surplus of deciduous fruit produced in this country, consumers still have to pay as much for the fruit as before the war. This is largely due to the fact that the price of packing material which is responsible for a

Experimental Rice Field at Umhlatuzi, Zululand. Note dryland-rice in immediate background. [*Photo, A. V. Berry.*

considerable part of the cost of deciduous fruit, has more than doubled since the outbreak of war. However, except in the case of peaches and plums, of which the crop was very poor on the whole the consumption of the other deciduous fruits was appreciably higher during the past year than in previous seasons. Their quality also was excellent.

In co-operation with the Deciduous Fruit Board the Department of Social Welfare also instituted a scheme for placing at the disposal of the same classes of institutions as those mentioned in the case of the Citrus Board certain kinds of deciduous fruit at lower prices during the 1941-42 season. Under the scheme the price of grapes was 3s. per box of 40 lb. and that of apples and pears 6s. 6d. and 7s., respectively, per box of 40 lb.

In regard to the forthcoming 1942-43 crop more or less the same arrangements as those for the past year have been made. On the whole, however, intake prices have been slightly increased.

Dried Fruit.

This year the production of dried fruit (other than vine fruits) was fairly good again and amounted to approximately 8,100,000 lb. in comparison with only 4,142,091 lb. last year when the crop was very poor. This increase is largely due to the greater production of

dried pears. Once again the dried-apricot crop was poor and amounted to only 689,103 lb. Consequently, the prices of apricots were fairly high, and the Price Controller had to intervene and fix the wholesale and retail prices for apricots.

As regards vine fruits, the production of raisins was 13,383,533 lb. and that of unbleached sultanas 8,945,714 lb. Considerable surpluses were therefore available for export, and a contract was again concluded with the British Government for the delivery of the surpluses at fixed prices which were slightly higher than those of last year.

As was the case last year, the Dried Fruit Board was again appointed under Emergency Regulations (War Measure No. 8 of 1942) as the sole buyer of raisins, unbleached sultanas and currants. Other vine fruits may be purchased only with the permission of the Dried Fruit Board. The Board appointed a number of agents under contract to take in the raisins, unbleached sultanas and currants at fixed tariffs for the Board and to process and pack the surplus on its behalf.

The intake prices were fixed according to grade. They were calculated to ensure to producers an average price of 2·65d. per lb. for raisins and sultanas in comparison with 2·25d. last year. Any deficit on these intake prices will be borne jointly by the Government and the K.W.V. In the event of there being any surplus in respect of one of these fruits, it will be paid out in the form of an "agterskot".

As a result of the exceedingly good quality of the raisin and sultana crops, a larger percentage of the dried fruit than was expected, fell within the higher grades, with the result that the average prices for Orange River and Western Province sultanas worked out at 3·139d. and 2·686d. per lb. respectively, and those for raisins at 2·925d. per lb., instead of the estimated 2·65d. per lb. As regards currants, producers received an average price of 3·46d. per lb. and, in addition, are entitled to an "agterskot" of 1·383d. per lb. The prices received by producers for their vine fruits are, therefore, better than those of last year.

Viticultural Products.

The total Wine crop for 1941 amounted to 396,711 leaguers against 326,053 leaguers the previous year. This reflects a continued increase in production, and it is sincerely hoped that the control exercised by the K.W.V. over good wine has brought about an increase in the quantity of good wine produced.

The outstanding event in the industry during the past year was the institution of a scheme which makes possible the limitation of alcohol production. This scheme was announced in the annexure to General Notice No. 816 of 1941. In the main the scheme makes provision for the allotment of a quota to each wine farmer, based on the number of vines on his farm on the date (1 November, 1940) on which Act No. 23 of 1940 came into force, irrespective of the fact whether such vines were used in the past for the production of alcoholic products or not. Provision is also made in the scheme for planned expansion of the industry, the improvement of existing vineyards, and the future reduction of production.

The war has naturally affected the export market for brandy and wine very seriously, especially that in Great Britain, to which large quantities of these alcoholic liquors were sent before the war. On the other hand, however, we have been fortunate in finding new markets. In this connection mention must be made of the outlet which has been developed in certain East African Territories and of

the increased quantities of brandy and wine sold to the United States of America. In addition, the greater consumption within the Union must not be left out of account. Since the outbreak of the war a considerable increase has taken place in the local consumption to such an extent indeed, that, together with the export to new markets, the loss of the pre-war export market has been largely made up.

In so far as prices are concerned, it should be mentioned that the prices of good and quality wine for the 1941-42 crop were fixed under Act No. 23 of 1940 at £10. 5s. and £6. 5s. per leaguer, respectively. These prices must not only be regarded as quite remunerative, but should also serve as an incentive to greater concentration on the production of improved wines.

Another important development in the viticultural industry during the past year was the exhaustive investigation instituted by the Broeksma Committee in cerain aspects of the qualities of wine, brandy and spirits. Arising out of the recommendations made by the Committee in its interim report, preliminary steps have already been taken towards the establishment of an Oenological Institute at the Stellenbosch-Elsenburg College of Agriculture and for the introduction of more effective machinery for liquor inspection in pursuance of the provisions of Act No. 15 of 1913. Both steps are of fundamental importance to the industry and their beneficial effect will be felt to an increasing extent in course of time.

Wattle Bark and Extract.

During the calendar year 1941 the export as well as the export value of wattle bark and extract was slightly lower than that of the previous year. If the past three years are taken as a whole, however, the production and export of wattle bark and extract must be regarded as a record. The great demand for tanning materials is responsible for this.

The production of bark has, in point of fact, exceeded the total output capacity of the industry and it is, therefore, imperative to guard against overtaxing of the industry. To that end it is necessary that wattle farmers should fully appreciate the need for a high degree of silvicultural efficiency in respect of the replanting of cleared areas.

During the past few years a high standard has been reached in this connection, and although such factors as a scarcity of labour and the absence of owners on active service make it difficult to maintain the present level, this matter cannot be ignored in view of the future of the industry. Indeed, signs of retrogression are already discernible in regard to the technique followed for the re-establishment of wattle plantations and their management. In the long run this will have an adverse effect on the quality and quantity of the bark. Since oversea competition on the future markets of the world will almost certainly increase in intensity, growers must devote timely attention to this important problem.

Once again severe attacks of the wattle bag-worm were experienced in restricted parts of the wattle-growing area. Research work in connection with the control of this and other entomological and mycological problems of the industry was continued.

Timber.

During the past year the importance of our state plantations in relation to the prevailing war conditions was emphasized still further, and there can be no doubt that they already fulfil a very important function in the economic life of the country.

More than 17,000,000 cubic feet of timber were sold. Of this quantity the plantations contributed 16,700,000 cubic feet and the indigenous Crown forests more than 400,000 cubic feet. Just over 10 million cubic feet, or approximately 60 per cent. of the total plantation output, consisted of softwood. Of this quantity roughly 6½ million cubic feet were supplied to private sawmills and about 3½ million cubic feet to the State sawmills. This means that the State plantations in this country produced approximately 4 million cubic feet of processed wood this year. In addition to the demand for softwood for sawing purposes, that for both treated and untreated poles was exceptionally heavy.

The State sawmills worked to their maximum capacity and concentrated almost exclusively on the production of building timber anl other requirements of Government Departments.

In view of the growing demand for softwood, it is probable that as a war measure, the Department will have to draw upon its capital supplies in State plantations. The position has been carefully analysed, and at certain places additional quantities of wood have been made available for sale. The Department naturally realizes that great caution will have to be exercised in such cases in order not to endanger the future supply of timber in this country.

IV. The General Activities of the Department.

IN view of the fact that it is primarily the economic side of agriculture which has come into greatest prominence under the prevailing circumstances, it was necessary to devote the major part of the report to the economic aspect of the agricultural industry. The conclusion is by no means justified, however, that the normal activities of the Department have been relegated to the background. Unfortunately, economies had admittedly to be effected in certain directions and no one regrets the fact more than the Department that such a course was necessitated by unavoidable circumstances. It may be recorded without hesitation, however, that the Department continued to serve and promote the broad interests of agriculture in numerous directions.

Unfortunately, owing to lack of space in so far as this report is concerned and the fact that the paper shortage does not admit of the publication of the various Divisional reports, this year's review of the general activities of the Department will necessarily have to be somewhat incomplete. In point of fact, only a selection could be made from among the most important subjects. Consequently, the review which follows here applies only to those matters which are of general interest and, more particularly, to such as are directly connected with the large-scale operations being carried out with a view to the reinforcement and maintenance of the foundations of the agricultural industry.

Safeguarding our Agricultural Resources.

The problems connected with the reclamation, conservation and rational utilization of the soil, veld and water supplies, the natural resources on which the agricultural industry of the country depends, once again received wide-scale attention. It is gratifying, therefore, to be in a position to record that there are unmistakable signs that the general public is realizing to an increasing extent that

the reclamation of erosion-stricken area, impoverished veld and arable land, and the conservation and judicious utilization of the soil, veld and water resources, are matters of cardinal importance. This growing interest definitely shows that the warnings and enlightenment work of the Department have not been in vain.

During the year a commencement was made with the production of films which graphically illustrate the dissipation of our most precious national assets—the soil, veld and water resources—in all four provinces, and which also afford indisputable evidence that the tremendous loss of precious soil, the devastating effects of soil erosion, and the deterioration which inevitably follows are not figments of the imagination but grim realities. Wherever these films were shown, in the rural districts as well as in the cities and towns, they were followed with the keenest interest and contributed in no small measure towards making those who attended, no matter what their profession or walk of life, erosion conscious. A further encouraging sign is that educational authorities are beginning to evince a lively interest in matters pertaining to soil and veld conservation, and are taking steps to introduce into the school curricula studies connected with the subject.

Soil-Erosion Control.

A scheme, under which the Government grants technical and financial assistance to land owners for the control of soil erosion and the provision of stock watering facilities, was again instituted in April, 1942. Actually, this is a partial continuation of the schemes suspended in June, 1940.

The assistance granted to applicants under the old scheme A (i.e., at own cost, with a bonus) and scheme B (i.e., with the assistance of a loan) is taken into account in calculating the bonus paid to applicants under the present scheme. The position is, namely, that, if an applicant has received a bonus and/or a subsidy on an amount of £400 under the old scheme A and/or B he can now receive no further assistance. If, however, he has already received a bonus on, say, £300, he is still entitled to a bonus on the difference between £400 and £300, i.e., on £100.

The bonus payable under this scheme amounts to 33⅓ per cent. of the final valuation of the works completed to the satisfaction of and with the prior approval of the Department. The highest bonus which the owner of one farm, who has not previously received assistance, can obtain is, therefore, £133. 6s. 8d. (i.e., 33⅓ per cent. of £400), while the owner of two farms cannot obtain more than £266. 13s. 4d., and the owner of three farms not more than £400 (as bonus). The maximum bonus paid per dam is £150.

Works previously completed under scheme C (i.e., with the assistance of semi-fit European labourers) are not taken into consideration in calculating the bonus now paid to applicants. Consequently, even if an applicant has reached the maximum amount allowed under scheme C, he can still make full use of the facilities now made available.

Applicants who previously applied under scheme C and whose works were approved but not yet commenced owing to the shortage of labour, may now apply in writing for such works to be carried out under the bonus scheme subject, of course, to the new restrictions applicable to the scheme.

The attention of land owners is drawn to the fact that works which have not received the prior approval of the Department and are carried out on their own initiative, will not be taken into consideration for bonus purposes. Before farmers undertake works,

they must first communicate with the Division of Soil and Veld Conservation (P.O. Box 965, Pretoria), or with a College of Agriculture or an extension officer, for full particulars.

In the course of the period of two years during which the schemes were suspended, many of the works previously approved were completed. Many farmers also continued with anti-erosion work without financial assistance from the State. An important development which took place during this period was that farmers definitely gave more attention to means and methods aiming at direct erosion control. In several districts a lively interest was evident in the construction of systems of contour banks for the protection of lands. Considerable and extremely useful work of this nature was undertaken and this is still being extended.

Good use was also made of the loan scheme inaugurated with a view to the granting of assistance for the repair of works which had been constructed under the various schemes and damaged as a result of exceptionally heavy rains and floods.

The Vlekpoort Conservation Area.

In pursuance of the provisions of the Forest and Veld Conservation Act of 1941, an area approximately 80,000 morgen in extent in the Lake Arthur catchment was proclaimed a conservation area. The area concerned embraces the Vlekpoort River and is known as the Vlekpoort Conservation Area. By proclaiming the area a conservation area, the State has indicated that it aims at the reclamation of the area as a whole.

In this conservation area deterioration of the veld and soil erosion in all its various forms has already assumed alarming proportions. The whole terrain is so severely drained by the extensive and frequently inter-connecting network of large and numerous sloots that the effectiveness of the annual rainfall has been greatly reduced. Indeed, not only does a very considerable part of the rainwater which should ordinarily soak into the ground, run off, but precious soil is also swept away in the process. This draining will first have to be checked by damming up the sloots, constructing contour embankments, etc., before there can be any hope of again establishing an effective vegetal cover on the soil concerned. As the vegetation slowly increases in course of time with the aid of mechanical works, artificial plantings, the sowing of seed, and effective veld management, the excessive run-off will be reduced, the natural equilibrium gradually restored, and the soil reclaimed to its pristine state of usefulness.

With this object in view, officers of the Department are conducting a careful survey of the veld erosion and general farming conditions on each of the farms, and will then formulate plans for the reclamation and conservation of the farm concerned. Several farmers are already engaged on constructional operations in connection with the prescribed reclamation work.

The following are the main features of the scheme of activities:

The State's Contribution.—(*a*) Farms and portions of farms, which are already so severely eroded that the cost of reclamation works will be too high for a private land owner to carry them out himself, will be reclaimed at the expense of the State. If the whole farm is very badly eroded and the veld has deteriorated to such an extent that farming operations must be suspended during the period of reclamation, the farm is expropriated, as has already happened in the case of the farm Uyenhoek. The owner of a purchased farm, or his successor in title, retains the right of pre-emption when, after its

reclamation, the farm is released again for farming purposes under prescribed systems of soil and veld utilization.

In the case of a farm where a considerable portion is severely affected, the owner's rights over that part are temporarily suspended in exceptional cases, and the necessary works carried out by the Department. Later on, the owner will be expected to pay part of the reclamation costs. His share will be calculated on the increased value of the land without regard to the actual cost of reclamation.

(*b*) A considerable amount of work must be done in and along the river. Retaining dams must be erected at strategic points and work undertaken along the banks in order to reduce scouring and undermining, and to stabilize the river banks along a properly defined course. These river works are being carried out at the expense of the State, and operations have already been started.

The Landowner's Share.—In addition to the works which will be carried out at the expense of the State, there are the reclamation measures which must be undertaken on the remaining farms and portions of farms. The practical execution of these measures is a comparatively simple matter and, consequently, they may easily be tackled by the owner himself with the assistance of the State. These minor works are dealt with under a special subsidy scheme in order to meet the owners financially. Under the existing Scheme, where the owner is in a position to construct the necessary work at his own expense, he will receive a bonus of 50 per cent. of the final valuation of such works upon the completion thereof in a satisfactory manner, provided he undertakes to carry out all the prescribed works and to maintain them in good repair and to carry out, in the future, such systems of soil and veld utilization as the Department may prescribe. The total amount of the bonus is limited to a maximum of £500 per owner. In the case of landowners who are not in a financial position to carry out the necessary works at their own expense, assistance is available in the form of long-term loans to a maximum amount of £1,000 per landowner. When the works have been satisfactorily completed, a valuation is made on the same basis as in the case of owners who erect the works at their own expense, and the bonus to which the owner is entitled, is deducted from the total amount of the loan advanced to him. Repayment of the balance may be deferred for a period of three years after the advance of the last instalment of the loan, which is then repayable over a further twenty years at a 4 per cent. interest.

In reality, these bonus and loan facilities are so liberal and attractive that landowners will undoubtedly prefer to carry out the prescribed work themselves, and not necessitate the enforcement of the provisions of the Act. Technical advice is given gratis, and officers of the Department will be at hand to give the farmers the necessary advice and assistance.

Enforcement of the Act.—In the event of a landowner not being in a position or willing to avail himself of the facilities offered and to carry out the work himself, or in the event of his failing to carry out the prescribed works in a satisfactory manner and to complete them within a stipulated period, the Department has no other choice than to enforce the provisions of the Act, that is, to suspend the owner's rights over the farm and to undertake the work itself. Eventually, after the reclamation of the farm has been completed, the suspended rights will be restored to the owner, subject to prescribed methods of utilization of the farm which will ensure that deterioration and destruction will not take place again. The owner's

share of the reclamation costs will be calculated according to the improved value of the farm.

The Department hopes, however that such steps will not be necessary and that it will be able to carry out this large-scale experiment in regard to soil and veld reclamation with the whole-hearted support and co-operation of the owners concerned.

Silo Scheme.

The silo scheme which was suspended at the same time as the soil-erosion schemes in June 1940, was partially re-instated in February 1942.

Owing to the lateness of the summer rains, it was apparent that a considerable portion of the maize crop would probably be caught by frost. In order to enable farmers to make the best possible use of such late maize, and in view of the fact that hay and grazing for the winter would be very scarce in many districts as a result of the damage caused by the army worm, it was decided again to pay a bonus on the construction of silos under certain conditions. The bonus amounts to 25 per cent. of the final valuation of silos previously approved by the Department and erected after 1 February 1942. The maximum bonus per farm is £50, and in the event of an applicant desiring to construct silos on more than one of his farms, the total bonus payable to him may not exceed £100.

This scheme, too, is regarded as a continuation of the scheme formerly in operation. This means that applicants who applied before the temporary suspension of the scheme in June 1940, and who have already received the maximum bonus in respect of completed silos, stock sheds and machinery, are not eligible for any further assistance. Applicants who did not receive the full bonus, however, can still obtain the difference between the maximum bonus allowed and the amount which they have already received. If, for example, the owner of one farm has already received a bonus of £30 under the old scheme, he can now still obtain a bonus of £20 in the event of his intending to build additional silos. The construction of stock sheds and the purchase of machinery, as well as repairs to and the improvement, completion or enlargement of existing silos, are not allowed under the scheme.

As in the case of anti-erosion works, applicants who desire to avail themselves of these facilities, apply for them beforehand, because a bonus will be paid only on silos previously approved by the Department and completed to its satisfaction. Particulars are obtainable from the Division of Soil and Veld Conservation, Agricultural colleges and extension officers.

Pasture Research.

The reclamation and conservation of our veld and the prevention and control of soil erosion are merely sub-divisions of one great problem. Although, as has already been indicated, public interest has made considerable headway in so far as the soil-erosion menace as such is concerned, and although many farmers are doing excellent work to combat erosion on their farms and to protect their lands, far too little is as yet being done to *prevent* erosion. The reason for this is probably to be found in the fact that it is not yet generally realized that it is such malpractices as injudicious veld-burning, overstocking and other injurious methods of veld management which have resulted in the wide-spread deterioration of the veld and that these practices are the root causes of soil erosion. Once the truth of all this is thoroughly appreciated, a more determined attempt will

no doubt be made by farmers to apply the results of what the Department has already achieved in its efforts to evolve methods of preserving the productivity of undamaged veld, and of restoring and subsequently maintaining veld which has already been damaged. The application of improved methods of veld utilization will not only benefit the veld as such, but will also be of particular advantage to the country's livestock industry.

The sixteen pasture research stations of the Department which are scattered throughout the country, are devoting special attention to investigational work which is of fundamental importance and designed to solve this great problem. During the past year the underlying principles of the utilization of the different types of veld, and their practical application were studied further and investigated at these institutions. The work is designed to provide information on sound methods of soil and veld utilization as a basis on which to plan suitable systems of farming adapted to and in harmony with the natural soil, veld and climatic factors of each particular area. This is the only foundation on which a stabilized and lasting farming industry can be based and is, therefore, the real and permanent solution of the soil erosion problem and everything associated with it.

The following is broadly the programme on which these activities are based:—

(*a*) The development of systems of veld utilization and management which will not only ensure the preservation of soil and veld, and be of benefit to grazing animals, but will at the same time also prevent weed encroachment and soil erosion;

(*b*) the making of veld hay and its use in the various systems of utilization;

(*c*) the reclamation of damaged veld:

(*d*) the utilization for pasturage and fodder production of old exhausted lands which are at present almost useless and exposed to the ravages of soil erosion;

(*e*) the study of indigenous and exotic grasses and other perennial fodder crops in respect of seed production, propagation, methods of management, their utilization and suitability for pasturage, hay and silage;

(*f*) the rôle and function of grass in systems of rotationel cropping for the maintenance of the fertility and structure of the soil;

(*g*) the improvement of grasses, by breeding and selection and the investigation of problems affecting the provision of grass seed;

(*h*) the study of fodder trees, bushes and shrubs;

(*i*) the profitable use of surplus grass, old grass and all organic farm waste material for the making of compost; and

(*j*) the summarization and application of experimental results and findings in devising sound systems of farming in which exploitational cropping, impoverishment of the soil and veld and, consequently, erosion, are prevented.

All the work is of fundamental importance in connection with the reclamation and conservation of the soil and veld and the maintenance of the natural water supplies. On sloping lands where small sloots have already made their appearance, further erosion can be considerably delayed with the assistance of mechanical measures such as, for example, the construction of contour embankments and furrows. The application of mechanical measures is, however, merely a treatment of the *results* and not of the *causes* of the evil and, therefore, cannot be regarded as a permanent remedy or solution. In so far as their lands are concerned, farmers still do not realize that

visible erosion is indisputable proof of agricultural malpractices which inevitably result in the deterioration of the natural structure of the soil, a reduction in its water-absorption capacity and an increase in its erodibility.

For these reasons, the work, as set out in paragraphs (*f*), (*i*) and and (*j*) above, is of particular interest to the farmer whose duty it is to ensure that the soil is not washed away from his lands and that he will continue to obtain good crops from them. One-sided methods of soil piracy will have to make way for methods of strip rotational cropping along the contour, and in many cases between contour embankments and furrows, in which cereal, fodder, root crops, and legumes, and grasses which last for more than one season on a strip, occupy a place. Farmers will have to realize that a suitable perennial grass for hay and/or grazing is the natural agent to employ in re-establishing and maintaining the structure of the soil, its water-absorption capacity and its resistance to erosion. In this connection the use of manure and compost made from organic farm refuse which is still largely neglected will have to receive greater attention. In other words, the contribution which the animal must make towards the maintenance of the soil and its productivity will have to be given due consideration. The objective is, therefore, a balanced farming enterprise in which the animal, the veld, the soil, the crop-production activities and their joint waste products, namely manure and compost, are co-ordinated into a suitable farming entity where the dependence of the one upon the other is taken into proper account.

The importance of the work already done and still being done in this direction has gained greater prominence now that the increased production of animal products has suddenly become an urgent necessity. The utilization of surplus summer grass for the making of hay and compost, for example, has been advocated for many years, and if this practice had been more widely adopted in the past, it could now have been a routine activity on the farm and many of the difficulties experienced to-day would not have arisen. For many years the making of large quantities of compost has been a normal function on all pasture research stations. Advantage has been taken of every possible opportunity to bring the importance of compost to the notice of farmers, but, unfortunately, these efforts have not been rewarded with much success. Greater interest is now being displayed, however, as a result of the scarcity of fertilizer and the necessity for increased production. It is sincerely hoped that this interest will not be only temporary.

A new development is that in connection with the production of grass seed. In the past, the bulk of the grass seed used in the country was imported from oversea. Owing to import difficulties, a problem has now arisen in regard to the supply of grass seed. Districts which are suitable for the production of specific grass and clover varieties have been visited and efforts are being made to get farmers interested in the production of such seed.

The work in connection with the *Drakensberg Reclamation Scheme* made further progress during the year. The information already collected is now being applied on a number of farms under a co-operative system with the farmers. The stage for the application of the research result has, therefore, now been reached.

Eradication of Weeds.

Under the scheme by which State assistance is granted for the eradication of dense infestations of proclaimed weeds along rivers, very valuable work was carried out during the past year. Once again

gangs of labourers employed by the State were used along the various rivers, particularly with a view to the eradication of *burweed* and *cockle bur*. The position in regard to the densest infestations which have now been tackled for a number of seasons is such that the stage has been reached where the weeds have been so reduced that the work of control can in future be left to the riparian owners concerned. It should be emphasized, however, that the owners will have to continue giving their attention to the cleared areas, otherwise the weeds will rapidly increase again. This will not only be to the detriment of the owners concerned, but will also constitute a source of infestation for farms lower down the rivers.

In spite of difficulties such as the absence of owners on active service and the general scarcity of farm labour, the progress made with the eradication of other proclaimed weeds was, on the whole, reasonably good. The position is not so satisfactory, however, in regard to *starbur* and *dodder* growing in the veld. Apparently, many farmers do not pay sufficient attention to the eradication of these weeds, notwithstanding the fact that dodder and starbur are spreading at an alarming rate in certain districts. It is also necessary to issue a word of warning against the *wild tomato*. This weed is readily spread by seed and there are signs that it may rapidly multiply.

Good work was done in pursuance of the system whereby certain common weeds such a stramonium, Mexican poppy, Mexican marigold, etc., are proclaimed weeds in municipal areas at the request of municipalities, provided the councils concerned undertake to carry out the necessary work of eradication at their own expense. Certain municipalities on the Rand have achieved very satisfactory results.

When the Government assumed responsibility for the control of *jointed cactus* about ten years ago, strenuous efforts were made to eradicate the pest in the eastern Cape Province. Certain areas were cleared at great cost. Since the discovery of the cochineal insect, *Dactylopius confusus*, the mechanical method of eradication was suspended and the insect introduced. Excellent results were obtained with the insect, dense infestations along the Keiskama River, for example, being totally destroyed. It was hoped that jointed cactus would be brought under complete control, but now there are signs of deterioration in the position. The weed has increased again on farms which had previously been cleared at the expense of the State, but owing to the scattered nature of the stand, and for other reasons as well, effective use cannot be made of the cochineal insect. It should be emphasized here that the responsibility for the further control of jointed cactus rests upon the landowner or occupier, and that it is his duty to ensure that the pest does not spread again. The Department cannot allow its work to be frustrated.

As is already generally know an effective agent has been found in the cochineal insect, *Dactylopius opuntial*, for the eradication of ordinary *prickly pear*. The insect is also being used outside the biological area, and colonies from which the further distribution of the parasite may take place, have been established in all the provinces. Dense stands of prickly pear have already been destroyed by the insect and there is no doubt whatever that in the campaign against the prickly pear pest the Department has discovered a very powerful ally in this parasite. It appears to be much more effective than cactoblastis which, so far as can be determined at present, has in all probability reached the peak of its usefulness. Cactoblastis has admittedly thinned out prickly pear infestations in many places but is incapable of bringing about the complete collapse of the pest. Unfortunately, there has been an appreciable increase in the number

of natural enemies of the cochineal insect, and although great things are expected of this parasite, due account will have to be taken of this hampering factor.

Fears are frequently expressed that the cochineal will attack other plants and destroy established plantations of spineless cactus. The insect lives only on cactus species, however, and will not attack other plants. Spineless cactus may, admittedly, be destroyed by the insect, but plantations can be safeguarded by not liberating the cochineal insect in their immediate neighbourhood, by eradicating possible stepping-stone prickly-pear plants by which the insect can gradually approach the spineless cactus plantation, and by regularly inspecting the spineless cactus with a view to the removal of cochineal insects which may have made their appearance.

The Cattle Improvement Scheme.

Cattle improvement continues to be one of the principal activities of the Department, not only from the point of view of the cattle-improvement scheme, as based on the principles contained in Act No. 48 of 1934, but also in regard to extension and research work designed to solve the fundamental problems relating to improved breeding and feeding.

During the year more than 30,000 bulls were inspected in proclaimed cattle improvement areas, and of that number slightly less than half were approved. A sum amounting to approximately £75,000 was paid out under the bull subsidy scheme in respect of approved bulls purchased in those areas, which means that the average subsidy was £9. 2s. 4d. per bull.

As was announced last year, the cattle improvement scheme will definitely lapse on 30 June 1945, and no area will enjoy the benefits of the bull subsidy scheme for a longer period than 7 years. In the meanwhile, however, new districts will be considered for proclamation as cattle-improvement areas. In pursuance of this policy a considerable number of new districts were proclaimed during the past year, while the period for the payment of subsidies on the purchase of approved bulls lapsed in the case of 40 districts. As a matter of fact, the general position is that the bull-subsidy scheme is drawing to an end in a large number of proclaimed areas.

Of course, this does not by any means signify that the comprehensive programme of the Department in respect of cattle improvement will cease to be carried out. On the contrary, the bull-subsidy scheme was from the very outset regarded merely as a temporary measure of encouragement intended to inaugurate the great work of cattle improvement and to assist in laying the foundation on which cattle farmers themselves must continue to build. It should be borne in mind in this connection that practically all the cattle districts of the Union have now been proclaimed as cattle-improvement areas and that the obligations which the farmers themselves have assumed in regard to the replacement of rejected bulls still rest upon them in the same way as before. Now that the foundation has been laid and a large number of improved bulls is available in the country, farmers can, with the technical advice and guidance of officers of the Department, continue to improve their herds. It is also gratifying to be able to record that we have already made substantial progress in this direction. There is no doubt whatever that the general standard of our cattle is to-day considerably higher than it was five or six years ago. This fact is of paramount importance for a pastoral country such as South Africa.

We can and must make still greater progress, however. There are as yet far too many scrub cattle in the country and many of our cattle herds can be built up to a higher degree of usefulness and productivity. Our farmers must, therefore, continue to persevere with this important work, and they may rest assured that, in so far as the available personnel permits, the Department will continue to contribute its due share.

Control of Stock Diseases and Agricultural Pests.

The work done by the Department in connection with the control of stock diseases, insect pests and plant diseases ranks among the most important of its functions, since South Africa is one of those countries where the task of the farmer is seriously hampered by the adverse effects of a large number of diseases and pests which attack his natural means of production. Our farmers have to cope with diseases among stock, diseases in the soil, diseases in crops, diseases in fruit and other trees of economic importance, diseases, in fact, in practically every field of agricultural production. In this struggle the farmer fortunately has a strong and active ally in the Department, and during the last year the Department continued to pursue a vigorous campaign against these enemies of the farmer.

Stock Diseases.

Although the veterinary work of the Department was conducted on a somewhat reduced scale during the past year, the work was systematically maintained, both in the field and at the Veterinary Laboratory at Onderstepoort.

Perhaps the most important achievement of the year in this field was the success of the research work undertaken for the control of the *blowfly pest*. For many farmers the results of this work are of the utmost importance, and it is for that reason that they are briefly outlined here.

From the outset blowfly research was planned on a broad basis in order to include all aspects of the problem. In consequence of the results and indications obtained during the course of the investigation, however, greater attention was focussed on certain definite directions which promised important practical results.

One of the problems which received special attention was the importance of carcases as breeding places for blowflies. It was known that the eggs of the most important blowfly, the green fly *Lucilia cuprina*, are laid in the carcase of an animal soon after the latter has died and that the other species of blowfly arrive later when the carcase is in an advanced state of decomposition, the presence of the different species of maggots resulting in very active competition. In other countries such as, for example, Australia, England and France, it was found that the competition may be so strong during certain times of the year that few sheep blowflies emerge from the carcase. The position in the Union with the different species of blowfly occurring here was unknown.

The experiments threw valuable light on this subject. It was ascertained, in fact, that the large blue-bottle, *Chrysomyia marginalis*, which does not cause blowfly strike in sheep or occur in the other countries mentioned above, is very active during the summer months and competes very strongly with the maggots of the sheep blowfly in the carcases of animals. It also arrives soon after the death of the animal to lay its eggs in large numbers, and the maggots feed and develop very rapidly. Whereas the green sheep blowfly lays no more eggs in a carcase in which maggots have already

developed, the blue-bottle continues to oviposit in such a carcase. Furthermore, in some way or other not yet fully understood, the maggots render the carcase unsuitable for those of the sheep blowfly so that the latter leave the carcase to die in large numbers, or die in the carcase itself. The result is that when the blue-bottle is active during summer, a carcase will not produce a single blowfly. The only species of blowfly which is able to breed in a carcase together with the blue-bottle is the banded green blowfly, which produces hairy maggots and causes blowfly strike in sheep only after the animals have been infested by other sheep blowflies. This species of blowfly will lay its eggs in a carcase which has already reached an advanced stage of decomposition.

During winter when the blue-bottle is not active or is present only in small numbers, the sheep blowfly breeds on a large scale in carcases. Consequently, there is no competition. It is important, therefore, that all carcases should be destroyed during this period either by burning or by burying them after they have been dusted with poison (arsenite of soda). In summer, when many blue-bottles are seen around carcases, a carcase should be left exposed for two or three days and then buried without having been treated with poison. The blue-bottle maggots which are present in the carcase will then develop further. The carcase should not be left exposed for longer than three days, however, otherwise the banded green blowfly will breed in it, and this must be prevented.

Since the green sheep blowfly is attracted only by a fairly fresh bait, and the blue-bottle by fresh as well as old bait, a blowfly trap baited with fresh bait will catch large numbers of sheep blowflies for a day or two only, in addition to a considerable number of blue-bottles. After that, however, mostly blue-bottles and other species will be caught. The use of blowfly traps, is therefore, not recommended since they are more likely to do harm than good, owing to the fact that it is not possible to keep them continually baited with fresh bait.

Another important conclusion arrived at is that during summer the sheep blowfly can breed only on living sheep because the maggots live in flesh alone, and not in dung or other substances. The maggots which occur on sheep must, therefore, be killed and the multiplication of the blowfly prevented in this way. No single remedy used in the past for the treatment of infested spots on sheep ever destroyed the maggots effectively and this is undoubtedly an important reason why the pest continually assumed more serious proportions. As a result of the research work carried out, a spray which will effectively destroy the maggots, has now been evolved, while the information gained in respect of the factors which make wounds attractive for blowflies and of the measures which are necessary to ensure the rapid healing of such wounds, is also being applied in the composition of the spray so that its repellent and healing effects are exceptionally good.

The spray is prepared at Onderstepoort and sold to farmers at 3s. 6d. per gallon. If the tin container is included, the price is 6s. per gallon or 27s. 6d. for 5 gallons. The spray has been available for only a few months, and during the first two months of issue about 2,000 gallons were sold.

It is expected that correct methods of carcase destruction will encourage the blue-bottle, so that it will become increasingly difficult for the sheep blowfly to breed anywhere else except on a living sheep during summer, and that the regular and general use of the spray will effectively destroy the sheep blowfly in its breeding place on the

sheep. At the same time, however, crutching and the breeding of sheep which are wide and smooth in the breech are very strongly recommended in order thereby largely to reduce the attractiveness of sheep for blowflies. As a result of the new information gained regarding the part played by carcases, the regulations in connection with the compulsory destruction of carcases have now been repealed.

In so far as the common stock diseases are concerned, there is not much that is new to report. Unfortunately, a serious outbreak of *East Coast fever* occurred in Northern Natal and steps were taken to institute the necessary control measures. In the remaining parts of that province the position in regard to East Coast fever is satisfactory. The same applies to the Transvaal which was free from outbreaks during the year, as well as to the Transkei where only one new outbreak occurred. As was expected, new outbreaks occurred in the Peddie and East London districts and several farms were cleared of cattle. As a result of the intensive control applied and the co-operation obtained on the part of the farmers in general, it was fortunately possible to relax some of the restrictions which had originally to be imposed owing to the uncertainty of the situation in that area.

As regards *scab*, there were 21 outbreaks during the year. Of these, 15 occurred in the Transvaal. The general position is, therefore, very satisfactory, in spite of the increase in the case of the Transvaal. In connection with this province, account should be taken of the fact that outbreaks of scab are unavoidable in view of the large number of sheep moved to Swaziland every year for winter grazing.

No material change occurred in the *anthrax* position. In the Transkei more than 1½ million head of cattle were inoculated. This regular annual inoculation explains why so few outbreaks have occurred in that densely stocked area. Apart from the animals which were inoculated by the owners themselves, approximately one million head of cattle in the remainder of the Union were also inoculated by or under the direct supervision of the field officers of the Department.

Horsesickness was not very prevalent in the recognised horsesickness areas, although the disease caused considerable losses in a few small localities. Certain farmers in the Uitenhage, Oudtshoorn and Humansdorp districts also suffered severe losses.

Since *mastitis* is a disease which causes serious losses to dairy farmers, considerable attention was devoted to this malady. Evidence was obtained that an appreciable reduction in the occurrence of mastitis among dairy cows can be effected by the regular testing and subsequent isolation and treatment of infected cows.

Despite the large-scale destruction of the *tsetse fly* by means of the Harris trap, there was an unexpected increase in the number of flies, especially in the Umfolozi area. As a result of this increase in the number of flies in the reserves, several outbreaks of *Nagana* occurred in the adjacent areas. The Department is at present devoting attention to the measures which must be taken to cope with the difficulty.

Special efforts were also made to discover a dip which would be effective against the arsenic-resistant *blue-tick* which occurs in the East London area. These efforts were rewarded with success and it was found that an arsenic-nicotine dip (0.16 per cent. arsenic plus 0.04 per cent. nicotine), with seven day dipping, yielded the best results. At the same time, tests were also carried out with a view to determining the extent to which farmers can make use of scrap tobacco for securing the necessary nicotine. A leaching process was

evolved whereby successful use can be made of such tobacco. Particulars of the process have already been published in *Farming in South Africa.*

Locust Destruction.

During the past year it was again necessary to conduct a large-scale campaign against the red locust only, since no hopper outbreaks of the brown locust in swarm-formation occurred in the Union.

The brown locust.—The position in regard to this species remained quiet and satisfactory. Towards the end of 1941 there was an increase in the solitary phase of the brown locust in the Jacobsdal, and Clanwilliam districts, and although incipient swarms were expected in these areas, unfavourable climatic conditions prevented their appearance. In the other areas there was no appreciable activity on the part of locusts in the solitary phase, and it is therefore expected that incipient swarms will not occur on an extensive scale during the coming season. Consequently, the prospects for the 1942-43 season are favourable in so far as this species of locust is concerned.

The Red locust.—Early in October a small invasion of Northern Natal occurred and reports of flying swarms were received at the same time from various districts in the Transvaal. During November there was a considerable increase in the number of flying swarms and reports regarding the movement of swarms reached the Department from sixteen districts in the Transvaal and ten in Natal and Zululand. At this stage, however, large numbers of locust birds made their appearance in the Northern Transvaal and considerably reduced the size of the swarms.

During December the swarms in Natal and Zululand migrated southwards to Pondoland and ovipositing took place on an extensive scale in the Bizana, Flagstaff and Lusikisiki districts, and on a smaller scale in the Umzimkulu district. Eggs were also laid at scattered places in some of the southern districts of Natal. During the latter half of December a number of flying swarms again invaded northern Natal and ovipositing occurred over a large area, this being most severe in the Nongoma, Ubombo, Hlabisa and Lower Umfolosi districts. In January, 1942, large numbers of locust birds appeared in Pondoland, as a result of which the further southward movement of the flying swarms was checked and continued ovipositing prevented.

During the second half of January hopper outbreaks occurred in all infested districts and, since the hatchings were widely scattered in certain districts, the work of destruction was considerably delayed. The work was also hampered owing to the fact that many of the outbreaks occurred in native locations and uninhabited parts. In addition, control measures were held up by the heavy rains which fell during March, while repeated outbreaks in certain infested districts made more than one campaign necessary in the same area.

In spite of these difficulties, however, the work of locust destruction was carried out to a successful end and no damage was done to crops. Once again poison bait was used exclusively even in the sugar belt, and yielded excellent results under all conditions. In Pondoland and the southern portion of Natal the campaign was brought to a successful conclusion by the middle of April and in Zululand the work was completed in the first week of May. No hoppers in swarm formation reached the flying stage. During the winter reports were received of only a few small flying swarms in Natal and Zululand, but it is expected that more swarms will invade

the country from the north at the beginning of the forthcoming season.

Once again the magistrates in the various districts rendered excellent service in connection with the locust campaign, and the Department wishes to avail itself of this opportunity to convey its cordial thanks to the magistrates concerned for the valuable contribution which they made towards bringing the campaign to a succesful conclusion. The Department also wishes to express its gratitude to the farmers for the manner in which they co-operated.

The total expenditure incurred by the State on locust destruction during 1941-42 amounted to only about £16,000.

Other Insect Pests and Plant Diseases.

The research workers of the Department whose task it is to assist the farming community in solving the numerous entomological and mycological problems with which this country has to cope, once again did their utmost for the farmer during the past year. Their work was seriously hampered, however, owing to the fact that certain insecticides, which are dependent upon importation, were not obtainable. This was particularly the case with certain sprays which are almost indispensable for the control of certain pests. Strenuous efforts are being made to effect their importation and to discover substitutes for these substances. As will readily be understood, however, the latter is not a problem which can be solved in a short time.

Perhaps the most important agricultural pest which occurred during the year, was the *army worm* which made its appearance over large parts of the country and caused considerable damage. In the introductory portion of the report it was indicated what steps were taken by the Department to control the pest and to ameliorate the consequences of its ravages, so that it is unnecessary to discuss the matter further here.

Karroo farmers will be pleased to learn that several parasites have been imported from the United States of America in the expectation that they will attack the *Karroo caterpillar*, the conrol of which by mechanical and spraying or dusting methods appears to be out of the question. The mass breeding of these parasites is at present in full swing, and it is hoped that some liberations will be made during the forthcoming summer season.

Since increasingly large quantities of farm products are being stored in the Union owing to the prevailing conditions, special attention was devoted to *pests of stored grain.* There are numerous insects which attack such products as maize, wheat and rice in storage, and samples of cereals from the various grain elevators are continually subjected to analysis in order to guard against infestation. A special study is also being made of the factors which are conducive to the infestation of manufactured and semi-manufactured products.

In so far as the deciduous fruit grower is concerned, the *codling moth* remains the most serious problem. Successful methods of control have been evolved through the use of nicotine and oil, but, owing to the scarcity of these materials, a very difficult position has arisen. Field and laboratory tests are being conducted on a large scale, however, in an effort to cope with this problem. The codling-moth problem has also been tackled from another angle, namely that of the development of methods calculated to eliminate infestation in export fruit. A consignment of pears dispatched to Southern Rhodesia was treated with methyl-bromide gas with excellent results.

As regards citrus, considerable progress was made with the investigational work which is being carried out with a view to discovering an effective measure against *red scale* in citrus.

Particular attention was devoted to *vegetable pests*. In the case of potatoes especially, there is an urgent need for more reliable information regarding the control of eelworm, and the experimental work in this field has been considerably extended.

Once again the plant regulatory service proved to be of inestimable value in that it prevented the introduction of new pests into the country through the various ports, from where they could spread. The entry of no fewer than ten exotic forest pests in imported timber was checked in this way. Immediate steps were taken after the pests had been discovered and the danger was averted. After the discovery of the first infestation special regulations were brought into operation, and consignments of timber are now very carefully examined before they are allowed into the country.

The work which is being done for the benefit of grape farmers against *bacterial blight*, was continued. Further inspections of nurseries and vineyards in the infected areas were carried out, and the movement of all vines is still being controlled in the areas concerned. Furthermore, a beginning was made with an experiment designed to provide data in connection with the cultivation of varieties which are resistant to this disease. As will be understood, this resarch work is necessarily of a long term nature and some considerable time will have to elapse before decisive results can be obtained.

Vegetable farmers on the Cape Flats are deriving increasing benefit from the research work being carried out at the Experiment Station there in connection with certain *vegetable diseases*. So, for example, the study of the manganese, deficiency in vegetables, and especially in beans and potatoes, has yielded important results. Very encouraging results were also obtained with the tests for the control of virus diseases in tomatoes. Indeed, this work was so successful that, on the strength of the results, definite recommendations could be made to tomato growers.

During the past few years wheat producers have realized more and more the seriousness of the considerable losses caused by certain *wheat diseases*, especially foot-rot. An experiment was therefore started in the Caledon district with the object of determining the effect of soil cultivation, as well as the resistance of the different varieties against foot-rot. The experiment will extend over a period of three years, but the work of the first year has already shown that certain varieties are highly susceptible to this disease.

These few examples are sufficient to indicate that the important work which is being undertaken in connection with the control of plant diseases and insects pests was successfully continued in spite of the difficult problems created by the war.

Nodular-worm Remedy.

"Owing to the lack of certain raw materials, the Division of Veterinary Services at Onderstepoort is unable to manufacture further supplies of Nodular-Worm Remedy. It is uncertain as to when the raw materials will again be on hand, but it is anticipated that the manufacture of the remedy will again be commenced with towards the end of February or beginning of March 1943 when the necessary publicity will be given."

Influence of Colour and Coat Cover on Adaptability of Cattle.

J. C. Bonsma, Animal Husbandry Research Officer, and
A. J. Pretorius, Statistician, Division of Animal and Crop Production, Pretoria.

AS is well-known, the colour of an object determines the amount of sunlight which it absorbs or reflects, and this in turn, determines the temperature of the object.

As long ago as 1761 Benjamin Franklin described an experiment which he had carried out by placing pieces of cloth of different colours on ice in the sun. After a while he found that the black cloth had made by far the deepest impression in the ice, followed by the dark blue and light blue. The lightest coloured pieces of cloth, such as light red, yellow and white, had either sunk very little into the ice or not at all. He explained that the lighter colours reflect more light and therefore remain cooler. The logical conclusion is that dark coloured clothing should not be worn in a hot sunny climate.

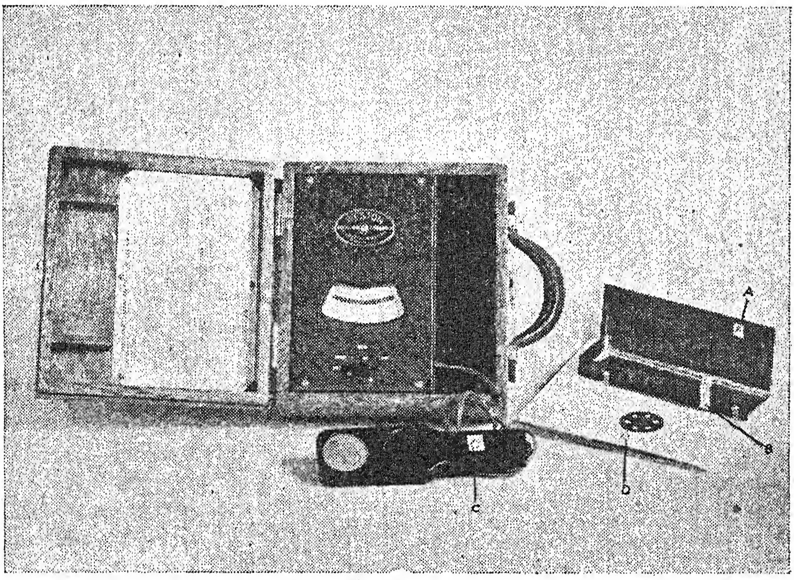


Fig. 1.—Weston-photometer Model 603. For determining light deflection the sensitive eye C is placed in the holder AB. By placing the shutter D over the sensitive eye C it is possible to determine the maximum limit of tropical light strength in candle feet.

Colour of Cattle.

The question now arises as to how far the colour of cattle affects the amount of sunlight reflected from their skins. This is a point of the utmost importance, since skin temperature is to a large extent dependent upon the amount of sunlight, i.e. radiant energy absorbed. A considerable rise in the skin temperature of an animal is accompanied by an acceleration of certain physiological reactions, as for example respiration, etc., and unless the superfluous energy

generated in its body as a result of the absorption of solar radiation is eliminated, the animal's body temperature will also rise.

For determining the percentage of sunlight reflected from the skin, an illumination meter is used to measure the direct intensity of the sunlight in foot-candles and at the same time to determine the strength of the light reflected from the animal's skin. The determinations referred to in this article were made with a standard "Weston Model 603" illumination meter.

The "electric eye" of the illumination meter is sensitive to light and is known as a photronic cell. When this photronic cell is exposed to light, sufficient electrical current is generated to move a needle on the dial of the instrument which is marked off in foot-candles. The light intensity is then read off directly in foot-candles. Although, within limits, the instrument is capable of measuring direct sunlight strength in foot-candles, it was necessary to place a model 703 multiplier over the sensitive eye of the photronic cell in

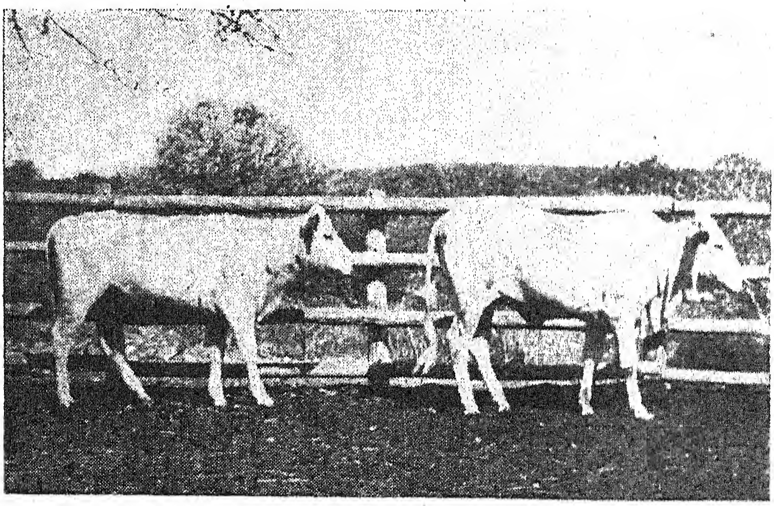


FIG. 2.—Left, a white Shorthorn heifer; the hair is long and dull and the skin is pink, the light colour of the skin leads to superkeratinization of the skin as a result of sunburn. Right, a cream coloured Afrikander heifer, with short glossy hair and a dark brown skin.

order to determine the upper limits of solar radiation. (fig. 1.) This multiplier excludes 9/10ths of the light from the electric eye. The reading thus obtained should, therefore, be multiplied by ten in order to determine the actual strength of the sunlight. For this purpose it is necessary that the rays of the sun fall perpendicularly on the photronic cell, with the switch turned to "high".

To determine the amount of direct sunlight reflected from a bovine's skin, the animal is made to stand at right angles to the rays of the sun. The photronic cell is then placed in the holder, side B being placed against the side of the animal so that the shadow of side A falls along the edge of side B. No direct sunlight will then fall on the photronic cell. (The light intensity reading obtained in this way indicates, therefore, the quantity of light reflected from the skin. The effect of diffused light from other sources falling on the photronic cell is constant for all animals, with the result that

differences obtained in the readings are due to differences in the amount of light reflected from the skin.)

Several research workers in the field of animal husbandry have observed that the colour of animals developed in tropical and sub-tropical areas or adapted to such regions, is light, i.e. the colour of these animals varies from red to white. (Fig. 2.)

Afrikander cattle of varying colour (Figs. 3, 4 and 5).

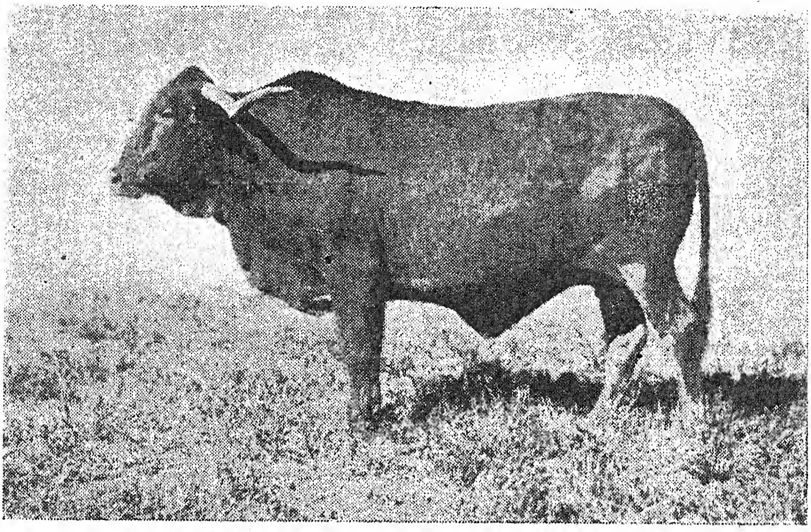


Fig. 3.—" MOOIDRAAI." A red Afrikander cow.

In his " Studies on Afrikander cattle with special reference to coat colour inheritance " 1938, F. N. Bonsma expresses the view that coat colour may possibly be genetically connected with physiological properties which determine hardiness. In these studies he further states that as yet no unanimity has been reached with regard to the degree in which animals with yellow coats are more resistant to high temperatures than those of other colours. In addition, several farmers in areas where both yellow and red Afrikander oxen are used for ploughing have frequently informed the writer that lighter-coloured oxen have greater stamina than red oxen.

Effect of Colour on Reflection of Sunlight.

In order to determine to what extent differences actually exist in the quantity of light reflected from animals of the same breed under constant environmental conditions, various tests have been carried out on Afrikanders of various colours but in the same condition and stage of shedding their coats. For this purpose, the colours of Afrikanders were divided into six classes, viz, dark red, blood red, red, golden yellow, light yellow and light cream. The animals were tested during summer and subsequently again in winter. During the winter months their hair was longer and duller, which gave the impression then that the animals were darker in colour. Actually, animals reflect much more light during the summer months than during winter. (See figs. 3, 4 and 5.)

Graph No. 1 indicates the percentage of light reflected by Afrikanders of different colours in summer and winter, respectively.

The same animals were tested at the same place first, in summer and then in the following winter.

At least five animals from every colour group were included in the test. The tests carried out during summer and winter clearly prove that not only the coat colour, but also the coat cover has an effect on the amount of light reflected.

The coat of Afrikanders is approximately four times as heavy in winter as in summer. The average coat of 6 Afrikander heifers weighing on an average 600 lb. each, was 29 grammes during summer, while the coats of the same 6 heifers six months later, during winter, each weighed 129 grammes. The entire coats of these heifers were cropped closely against the skin with a hair-clipper.

In view of the opinion that Jersey cattle represent one of the hardiest dairy breeds for tropical areas, the same tests carried out on Afrikander cattle were also carried out on Jerseys. Tests conducted in this country, as well as in sub-tropical countries oversea, have proved that Jersey cattle have greater resistance to high temperatures than most other dairy breeds.

The Jersey was developed in an area with a warm, mild climate and is a small dairy animal. The result is that this breed has a large skin surface per unit of weight, which contributes in no small

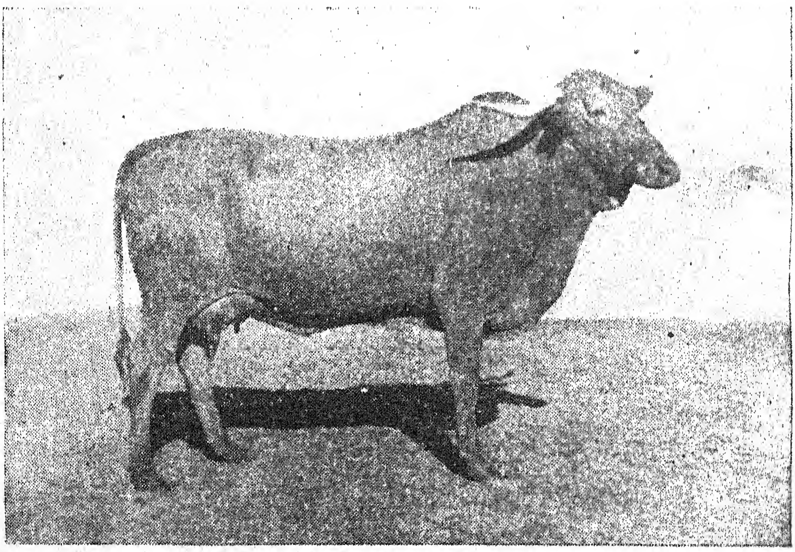


Fig. 4.—" MAE WEST." A golden yellow Afrikander cow.

measure towards preventing the body temperature from rising above normal, particularly where cooling down largely depends upon the degree of radiation.

(The above statement also explains to a certain extent why exotic beef breeds in a tropical climate tend to assume the conformation of a dairy type and why, as far as conformation is concerned, dairy breeds do not deteriorate as rapidly in the tropics as the exotic beef breeds.)

The yellow pigment in the skin of Jersey cattle is rich in carotin which, according to various research workers, is probably a valuable protective pigment against intense solar radiation.

A group of pure-bred and grade Jersey cows was divided into seven colour groups, viz., light grey, fawn, grey fawn, fawn, golden fawn, dark golden fawn (i.e. golden fawn with black pigment at the tips of the hairs), ash grey, and dark coffee-coloured. See figs. 6, 7 and 8). All these animals were tested at the same hour on a bright

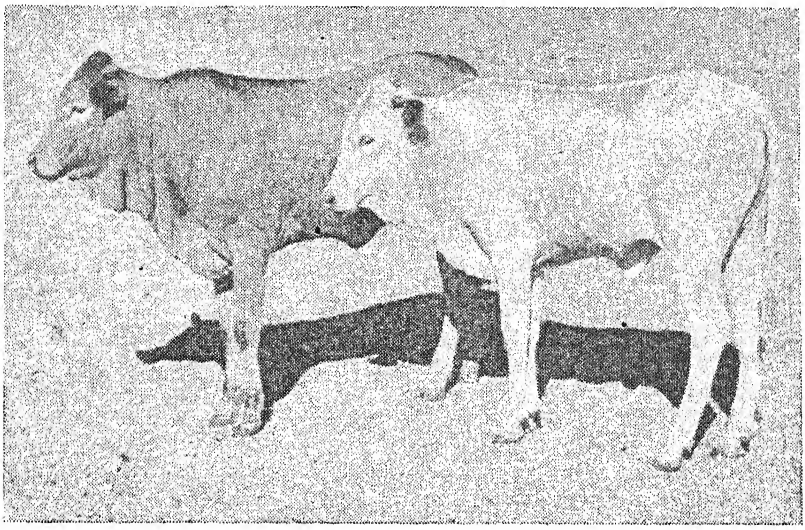


Fig. 5.—Golden yellow and cream coloured Afrikander calves.

summer's day and subsequently again on a bright winter's day. As in the case of the Afrikanders, it was found that during the summer months when the coat of the Jerseys was short and glossy, very much more sunlight was reflected than in winter.

An extremely interesting and important fact which emerged from the comparison of the amount of light reflected in winter by Afrikanders and Jerseys respectively, is that in winter the former reflected only 40 per cent. of the amount of light reflected by them in summer, whereas the figure for the Jerseys was 50 percent. The higher ratio for light reflected in winter and summer, respectively, in the case of the Jerseys, is ascribed to the fact that during the winter these cows were fed and groomed at night, while the Afrikander cattle were dependent on winter grazing. The difference in treatment resulted in the Jersey cattle having a comparatively smooth and glossy coat, while that of the Afrikanders was longer and duller. This feature indicates plainly that feeding and treatment definitely exercise an effect on the coat which in turn influences the facility with which an animal is able, by means of light reflection, to get rid of excessive heat.

Better Reflection from Light Coat.

The amount of light reflected from the skins of animals of different colours is directly correlated with colour intensity, i.e. the lighter the colour of the coat (in the same breed), the greater the amount of light reflected. It may, therefore, definitely be assumed

that, in the case of animals with lighter-coloured coats, the colour is a factor contributing towards keeping the animal's skin cool and is, therefore, related to the function of heat radiation.

Animals with dark coats which are adapted to a tropical climatic area, possess other characteristics, besides skin colour which enables them to withstand the tropical climate.

Graph 3 indicates that black bovines with a short summer coat reflect very little light. Consequently, it is a wrong practice to plough with black oxen in lowveld areas where oxen of lighter-coloured indigenous breeds can be used to greater advantage.

Another noteworthy fact brought out by Graph 3 is that a cream-coloured Afrikander ox reflects more sunlight than a white Zulu ox; this is probably due to the fact that many of the white hairs in the case of the Zulu animal are black-tipped with melanin, as a result of which the colour is not as uniformly white as in the case of the cream-coloured Afrikander. The Graph also reveals that a red Afrikander reflects very much more light in summer than a red Shorthorn of the same colour. In this case the difference is due to the fact that animals of the Shorthorn breed always have a very much heavier coat than Afrikanders.

The average weights of the summer coats of 6 two-year old Afrikander heifers and 6 two-year old Shorthorn heifers were 29 grammes and 303 grammes, respectively, in summer; their winter coats weighed 129 grammes and 505 grammes, respectively. (Fig. 9.)

Differences in Jersey colour (Figs. 6, 7 and 8).

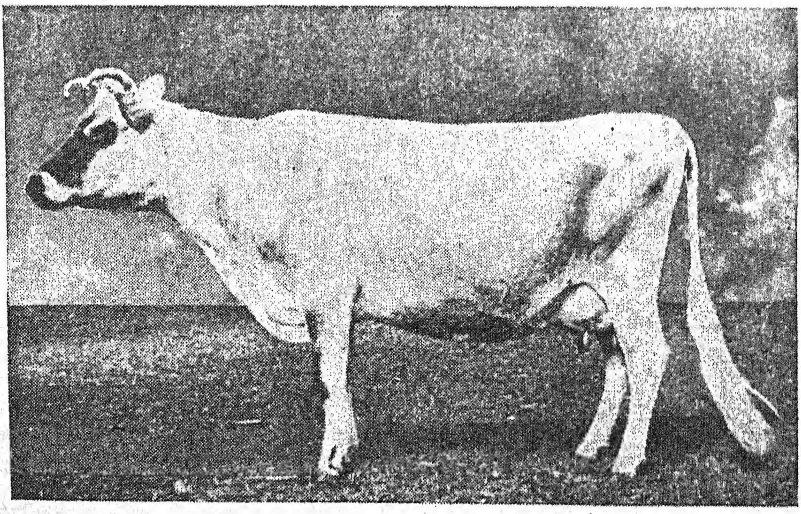


Fig. 6.—A grey fawn cow.
"Lady Sympathiser", an Imported Champion Cow.

Coat.

The growth of hair on bovines depends on numerous factors. The nature and type of coat found on animals of different breeds differ, and there is also a large degree of variation in the type of coat found on animals of the same breed. For example the coat of animals of indigenous breeds and those of animals of exotic beef-breeds differ greatly. Similarly, the coats of animals of the same

breed may show considerable differences. The coats of some animals are glossy, while those of others are dull.

The differences in the type of coat found on various breeds were originally the result of environmental factors. See, for example, the photo of the "Scottish Highland" animal—a class of animal adapted to a cold climate. A coat with a high percentage of downy, woolly hairs (like a fur) serves to protect the animal against cold. and this type of coat is generally found on cattle breeds developed in and adapted to a cold and cold-temperate area. (Fig. 10)

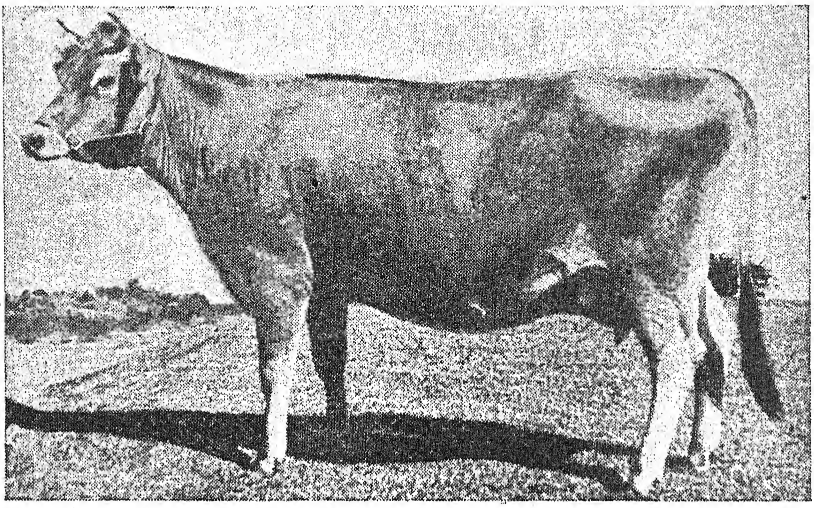


Fig. 7.—A golden fawn cow.

"Dreaming Margurite" No. 4644, a Promising young Cow.

Atmospheric temperatures, as well as the seasonal fluctuations in temperature, have a remarkable effect on the coat of bovines. (Figs. 11 and 12).

Experiments in Northern Transvaal.

Careful observations made on all the experimental animals kept at the Mara and Messina Experiment Stations, as well as on numerous other animals, have revealed that bovines with glossy coats usually have short, thick hair, while those with dull coats generally have a protective outer covering of long, straight hair and also an under-layer of warmth-retaining woolly hair.

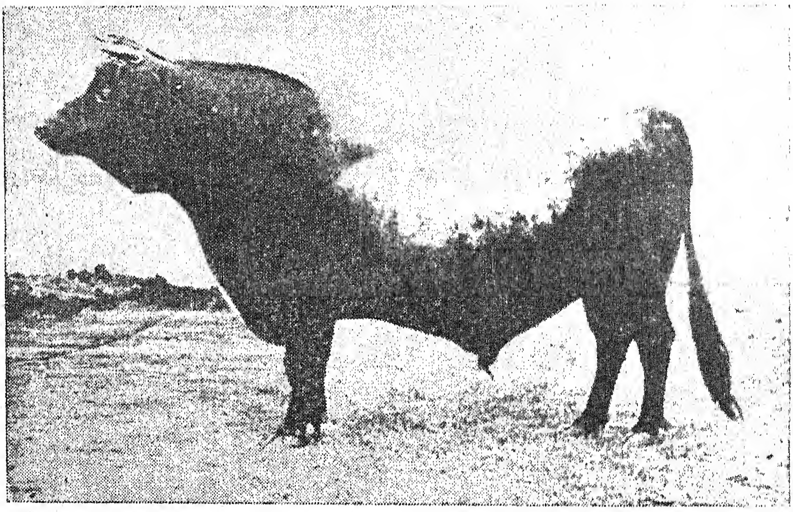
Duerden also found that in certain breeds of wild sheep the hair covering consists of two types of fibre, namely, an outer layer of straight, stiff inelastic hairs, and an underlayer of fine, curly, wavy, elastic hairs with no or hardly any medulla. The function of the outer layer of hair is probably of a protective nature, while that of the lower layer is presumably to retain warmth.

Measurements of the thickness of thousands of hairs from animals belonging to the various groups (viz. glossy and dull), indicate that the average thickness of hairs of animals belonging to the former group is greater and is subject to less variation. Graph No. 4 indicates the difference in hair-thickness distributio

the hair of a representative type of Shorthorn and that of an Afrikander. Three thousand measurements of hair-thickness were made of samples of hair taken from exactly the same part of the body of each animal. In the case of the great majority of these hairs from the Shorthorns, the thickness was 26 microns, the relative figure of Afrikanders being 50 microns. (See Figs. 13, 14, 15, and 6 and 7 for differences in structures of hairs.)

The hairs of animals with glossy coats not only have a more uniform thickness, but are also shorter and have a much higher fat content than those of animals with dull coats. From analyses made of large numbers of samples taken from the two classes of bovines, viz. those with glossy coats and those with dull coats, the ether-extract content (fat content) of the hair of the former is 4·2 per cent., while that of the latter is 2·9 per cent.

Histologically, it is possible that there is a difference in the development of sweat and fat glands in these types of cattle.



The Imported Bull "Check Mate of Oaklands".

Fig. 8.—A dark golden yellow bull. The tips of the hairs are black. Note the melanin stars on the skin.

In hot weather, the adaptability of animals like cattle depends to a large extent upon their external covering. The amount and rate of heat-elimination of which a bovine is capable, is directly proportional to the amount and rate of blood circulation in the epidermis.

The presence of a well-developed under-layer of hair considerably reduces the ease with which heat can be given off. Consequently an animal with a double coat always feels the heat much more. It has difficulty in getting rid of surplus heat, and as soon as the atmospheric temperature rises above 80° F., it begins to show signs of distress because its body temperature also rises.

Feed and Shedding of the Hair.

Feeding has an important effect on the coat of a bovine. Whereas underfed animals always have a fuzzy, dirty-looking coat, those

which receive a well-balanced concentrate ration with sufficient protein-rich constituents, and those which graze on good pasture, usually show a fine glossy coat after shedding their hair during early spring.

Some animals, however, have heavy, furry coats from their birth, and during warm weather are frequently in a state of fever. Such animals consequently also eat less and suffer from undernourishment.

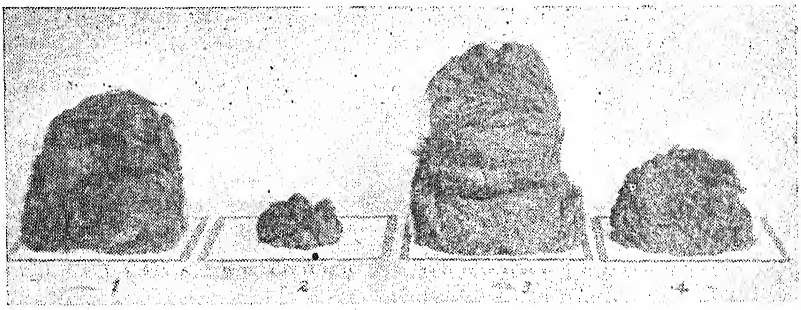


FIG. 9.—Above are the average samples of entire hair covering of 6 animals of each breed.

(1) Summer coat of a 600 lb. Shorthorn heifer. Weight of hair 303 grams.
(2) Summer coat of a 600 lb. Afrikander heifer. Weight of hair 30 grams.
(3) Winter coat of a 600 lb. Shorthorn heifer. Weight of hair 505 grams.
(4) Winter coat of a 600 lb. Afrikander heifer. Weight of hair 129 grams.
All the animals were clipped as smooth as possible with a hair clipper.

A Scottish Highlander.

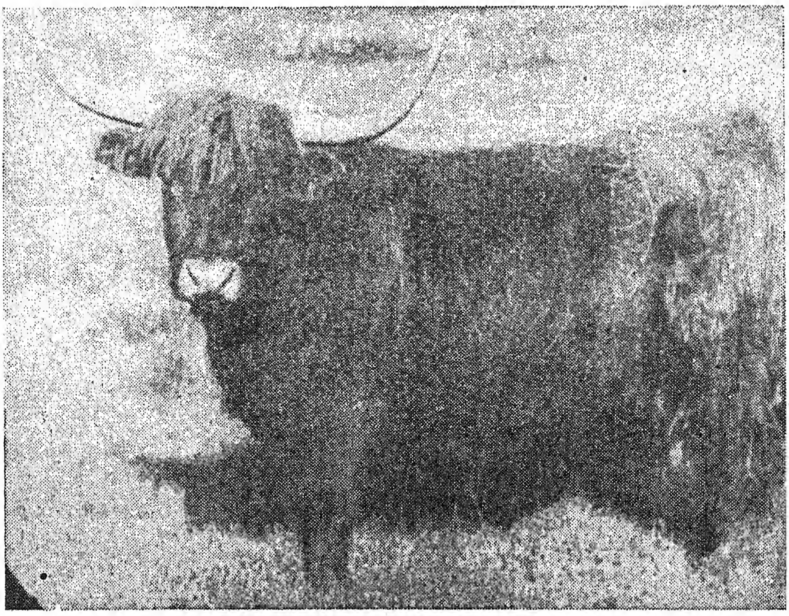


FIG. 10.—Note the animal's coat. It is perfectly adapted to the cold, stormy climate of the Scottish Highlands.

A heavy coat, in the case of cattle, can therefore be a cause as well as a result of underfeeding.

All calves of exotic beef breeds born at the Messina Experiment Station were divided into two classes at birth, viz. calves with a

The Imported Shorthorn Bull Calrossie Janitor (Figs. 11 and 12).

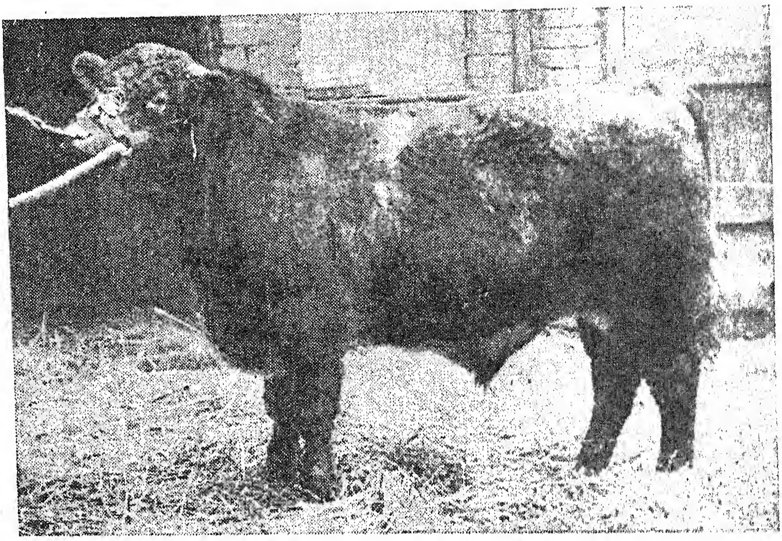


Fig. 11.—Calrossie Janitor in England shortly before he was exported. Note the length of his shaggy coat.

predominantly furry (downy) undercoat, and those with a predominantly smooth, glossy outer coat. The genetic difference in the coats of the two groups of animals lies in the relationship of the two types of hair present on them. In the case of the animals with a duller coat there is a greater proportion of warmth-retaining woolly-hair, while in the case of the smooth-haired animals there is more protective outer-hair. Although the conformation of all such calves was the same at birth, and although they all received the same treatment throughout, the former always suffered more in warm weather than individuals of the same breed with smoother coats. The accompanying graphs indicate the climatological reactions of eight similarly bred calves of exotic beef breeds in each group. On one day every two weeks for a period of one year, the animals were tested every two hours of the day for their reactions. (Graphs 5A and 5B.)

The animals were also kept under close observation in order to determine at what stage they began to shed their hair, and in what way the normal process of shedding hair takes place in the case of cattle. An interesting phenomenon came to light, viz. calves born with a comparatively smooth coat and which had shown less drastic reactions in warm weather, began to shed their hair long before those members of the same breed which appeared to be genetically better adapted to a cold-temperate climate. Cattle which shed their hair normally, lose their winter coat early in spring, i.e. in September or October. The hair-shedding process commences on the back. First of all a strip along the spine becomes smooth, followed

The smooth strip along the back then widens and gradually extends down the sides until all the old hair over the entire surface of the animal's body has been shed.

Weaner calves which do not commence shedding early in summer, after weaning, often do not lose their hair at all during the first summer. Such calves have hair of a dull, dirty colour, which is often matted and immediately gives one the impression of poor metabolism in the epidermis. Hair growth is dependent upon the supply of proteins and oxygen to the epidermis, and if this does not take place normally, the animal retains its winter coat during the succeeding summer. (Fig. 18.)

In the case of some of the animals the winter-hair along the lower parts of the sides is pushed out by a new growth of hair; this produces a "rise" under the winter-hair. In such cases, pieces of matted hair usually hang from the lower parts of the sides. As a rule, the hair above the middle of the sides does not become detached

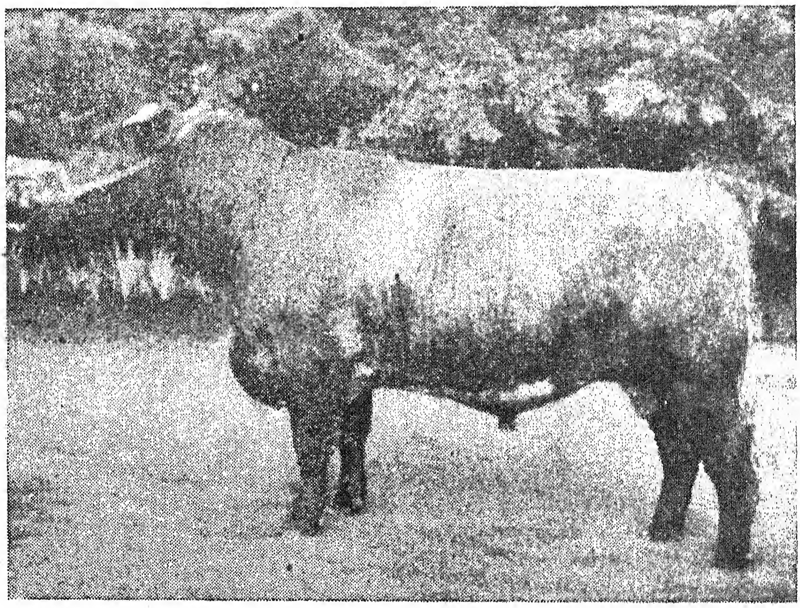


Fig. 12.—Calrossie Janitor six months later in South Africa.

and the animal retains its dirty, shaggy hair over the entire upper half of its body.

When they were still weaner calves, the test animals on the Messina Experiment Farm were divided into groups of early hair shedders and late shedders. All those calves which shed their hair before the end of October were regarded as early shedders. Some of the late shedders did not shed their hair at all during the first summer after being weaned, while others did not shed their hair even during the second summer after being weaned. A number of the animals are now entering upon their third summer and have not yet shed their hair. Those animals which shed their hair early have a much greater capacity for growth than those which shed their hair late. The average weight of the former group was 812 lb. at the age of $2\frac{1}{2}$ years, whereas animals of the latter group weighed 619 lb. at that age. As has already been mentioned, the animals were divided into

two classes when still weaner calves. Before weaning, all the animals received the same treatment, and subsequently their feed was also the same throughout. (Fig. 19).

It should be noted, however, that as the climate of an area becomes less sub-tropical, the differences between the groups of animals will gradually become smaller. That is to say, in a temperate area one would except the rate of increase in weight of the animals of both classes to be the same, while the increase in weight

Photomicrographs of Afrikander and Shorthorn hairs (Figs. 13, 14, 15, 16 and 17).

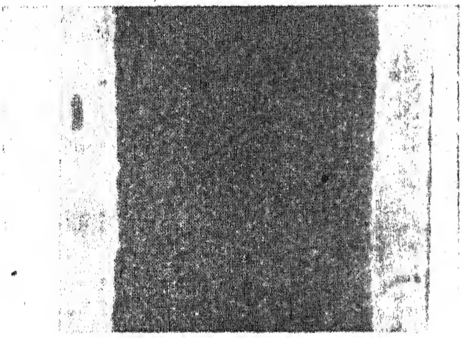
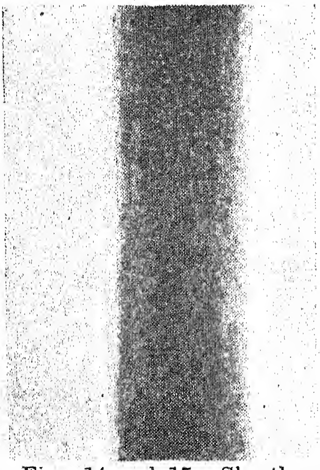
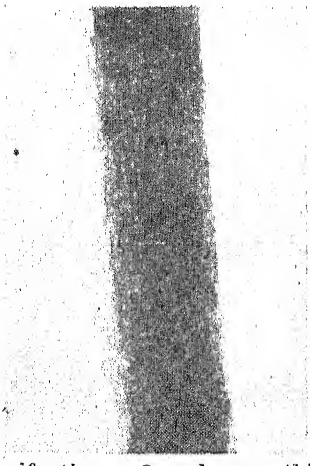


Fig. 13.—Afrikander hair of 400 magnifications. Note the thick medulla.

of the woolly-haired type of animal in a cold-temperate area would probably be more rapid than that of the smooth-haired type. In the tropics the differences between the two classes of animals will also be smaller at the end of winter than at the end of summer, provided adequate feed is available.





Figs. 14 and 15.—Shorthorn hairs 400 magnifications. One shows a thick medulla while the other has practically none. Hairs of the former type are usually straight, and those of the latter curly or wavy.

Hair Shedding and Sexual Activity.

As a group, those animals which shed their hair early also displayed sexual activity much sooner, 10 of the 12 animals in the group being in calf, whereas none of the animals in the group which

shed their hair late could be served owing to their retarded growth. Four of the 12 animals in the group have so far shown no sexual activity at all.

Animals—those with smooth as well as those with dull coats—which for some reason or other become underfed in warm areas, do not shed their hair at the normal times. As a result, an animal in this condition will also have difficulty after a time in getting rid of surplus heat owing to its coat, and will, therefore, be unable to benefit from good feed even when this is made available.

In tropical and sub-tropical areas one always finds that lean undersized animals have long hair. The opinion is often expressed that the animal is in too poor condition to shed its hair. Often the reverse is also the case, however; the animal is in poor condition because its coat is too thick.

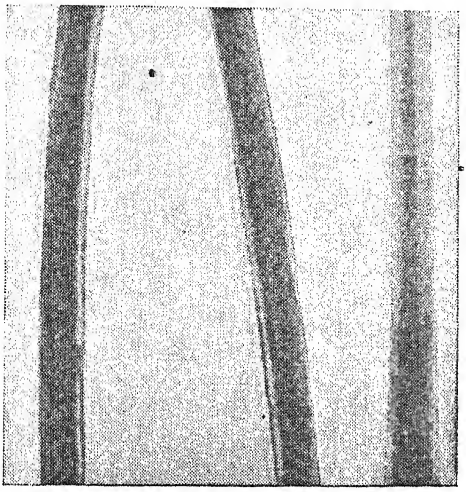


Fig. 16.—Afrikander hairs at 90 magnifications. Note that all the hairs are medullated and belong to the same type and show little variation in thickness.

Animals with a dense coat often have more ticks and other parasites attached to them, and, as has already been indicated in tropical and subtropical areas animals with a dense coat are generally in poor condition. Hence the assertion that lean cattle are always tick-infested.

Effect of Glands.

The ductless glands in the animal's body, especially the thyroid, pituitary and sexual glands also effect its coat.

In the case of the human being it is well known that sub-normal functioning of the thyroid gland has a restrictive effect on the growth of hair, nails, etc. In the case of animals this gland also affects the normal growth of hair, hoofs and horns, and if the gland is over-active or under-active, the growth of these tissues will be influenced.

Coarser hair is always found on male animals. The hair growing on the forehead and neck of a bull is much coarser and heavier than that of a cow. When bull calves are castrated at a very early age, their coats will subsequently resemble that of a cow more closely than that of a bull. Probably the sub-normal functioning of the pituitary gland in the tropics also influences the coat of an animal

Before the animals attain sexual maturity, the hormones, especially of the anterior portion of the pituitary gland, exert an effect on the normal growth and development of the animal.

In addition to the effect which this gland has on the growth and development of the animal, it also influences the metabolism by means of the control it exercises over the thyroid gland. Furthermore, the gland influences the mineral and carbo-hydrate metabolism of animals. All these functions are closely related to the normal nutrition of the animal; consequently, it is to be expected that nutrition would exert a noticeable influence on the growth of the hair and the coat.

Since glands and a normal supply of blood directly affect hair and growth, it is not surprising to find that when animals grow old and their physiological functions become less effective, the coat undergoes a change. Old animals frequently turn grey, particularly around the mouth and under the eyes. Uniformity of coat thickness is also frequently affected in old animals, bare patches often occurring on their necks. In addition, the straight hairs on old animals are much thinner than when the animals were young.

Selection of Animals for Certain Areas.

From the above it is evident that the normal functioning of the glands, as well as normal metabolism, is reflected in the condition of the coat. For this reason the coat serves as an excellent basis for the selection of animals suitable for the tropics and sub-tropics. In these regions the coat should be of a type which will enable the animal to get rid of excessive heat more easily. In cold and cold-temperate regions, the functions of the coat should be to retain heat

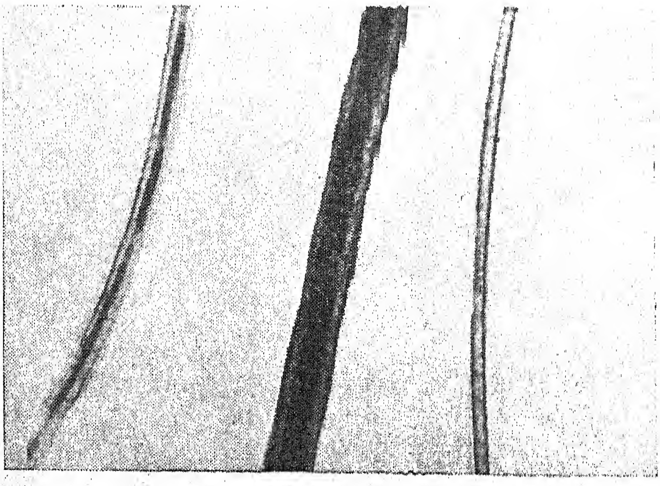


Fig. 17.—Shorthorn hairs at 90 magnifications. Note the absence of medulla in some of the hairs, and the great variation in thickness.

and to keep the body temperature constant by preventing the loss of too much heat-energy.

Almost 150 years ago, Bakewell and other famous English breeders selected animals with woolly, mossy hair for breeding and fattening purposes. This type of animal was eminently suited to the cold climate, and was capable of converting more of the energy by the neck and shoulders, and subsequently the rump and thighs.

derived from its feed into flesh and fat, since it required less energy for maintaining its body temperature.

Breeders of exotic beef breeds in temperate areas in this country should continue to breed cattle with "high" quality hair. Breeders of exotic beef breeds farming in hot areas would, however, be well advised to examine the coats of all newly-born animals and to cull all calves with woolly coats, since such calves will suffer much more from hot conditions and be impeded in their growth to a greater extent than those of the same breed born with a smooth coat.

Calves with woolly coats shed their hair late and sometimes fail to do so at all during the first summer after they have been weaned. As has already been indicated in the above photographs and graphs,

Differences in the Hair Covering of different Shorthorn Animals (Figs. 18, *and* 19).

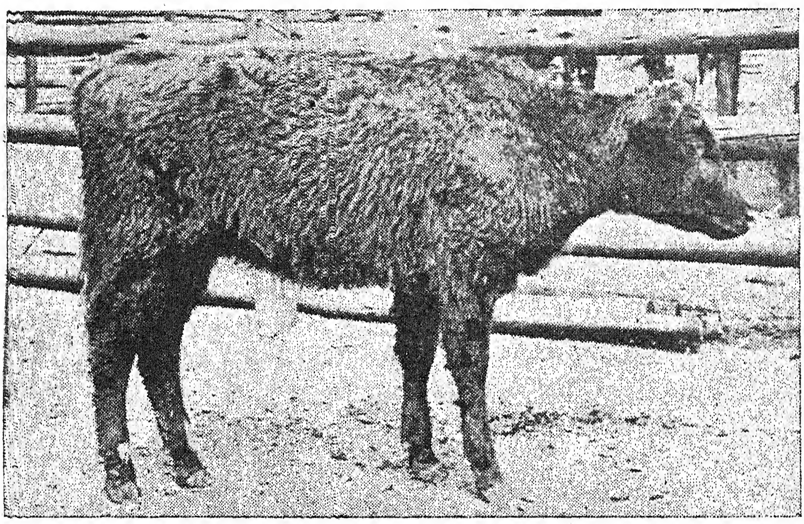


Fig. 18.—An animal slow in shedding its coat. The long shaggy hair always looks dirty. This Shorthorn heifer was born in May, 1941, and should have been shedding her coat for the second time (October, 1942). The calf had good treatment throughout, and was never ill.

they are less suited to the tropical and sub-tropical climatic areas. The breeding of such animals in these regions is, therefore, undesirable, since they make slow growth and calve a year or more later than animals of the same breed with smooth coats. The limits of areas in which exotic beef breeds may be kept without fear of degeneration due to high temperatures, may be extended, provided sufficient attention is paid to the above factors.

The foregoing also largely answers the question which is so often asked by cattle-farmers in the tropics, namely, "Why do some cattle of exotic beef breeds degenerate so rapidly in the tropics, while others appear to thrive?" Everything is a question of adaptability and the success of stock-farming in the tropics and sub-tropics depends upon the farmer's capacity for selecting animals with those characteristics which are calculated to bring the animal into harmony with its surroundings. (Gr. VI.) Proper selective breeding will considerably increase the farmer's profits. The fertility of his animals and their capacity for growth will be improved and there will be a corresponding reduction of expenditure in the management of his

herd. Nature itself appears to work against the survival of weak, sickly, under-developed animals which require constant treatment and are ill-adapted to their environment.

Summary and Practical Application.

It is evident from the above that animals with light coats, are better adapted to tropical and sub-tropical conditions than similar animals with dark coloured coats, provided the skin colour is dark.

The colour of the coat can therefore be regarded as of economic importance in the breeding of animals for the lowveld areas where intense sunlight is an important ecological factor.

Cattle breeders in these areas are therefore advised to make greater use of light-coloured animals, especially bulls of those breeds adapted to sub-tropical and tropical climatic conditions.

Since it may be assumed that that portion of the solar radiation which is not reflected, is absorbed by the skin, thereby reducing the

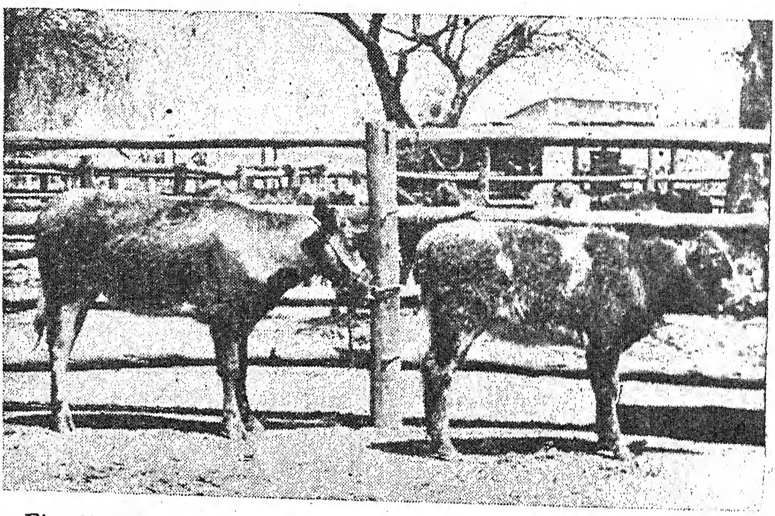


Fig. 19.—The two heifers are of exactly the same age and have had the same treatment throughout. The larger is already shedding her coat for the second time. Note that the neck, parts of the shoulders and the top line are already smooth. The smaller animal has never shed her coat yet.

ability with which the animal can get rid of excessive heat, it is necessary in the breeding of animals for lowveld areas to take into consideration other factors besides the colour of the coat which affects reflection and the absorption of heat rays.

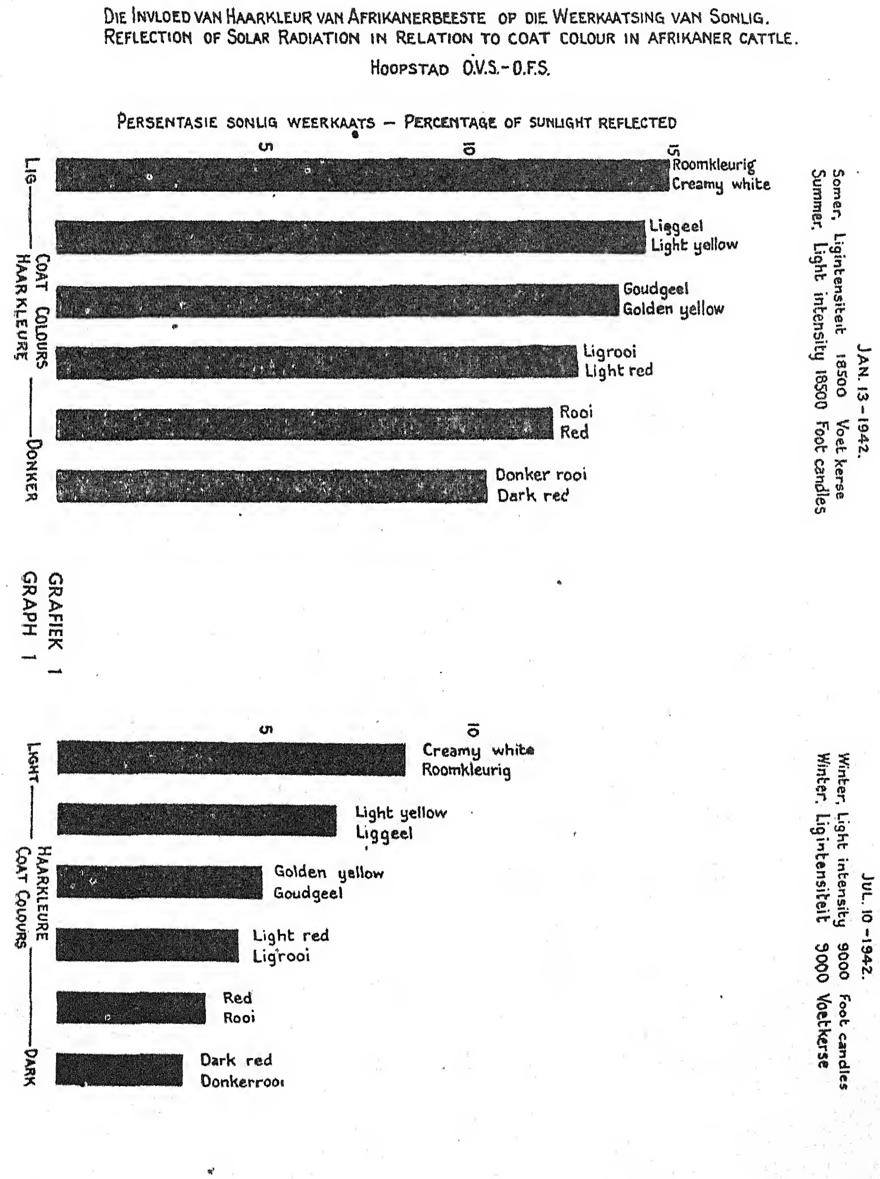
It would, therefore, as has already been indicated, also be advisable in tropical areas to make more use of smooth-coated bulls and, if possible, to make greater use of smooth-coated animals for breeding purposes.

In nature, environment is largely responsible for the types of animals which survive; those types that cannot adapt themselves to a certain set of environmental factors, must inevitably perish.

Fortunately, however, breeders of farm animals can, to a certain extent influence the adaptability of farm animals by using for breeding purposes only those animals which are best suited to a definite environment.

Acknowledgment.

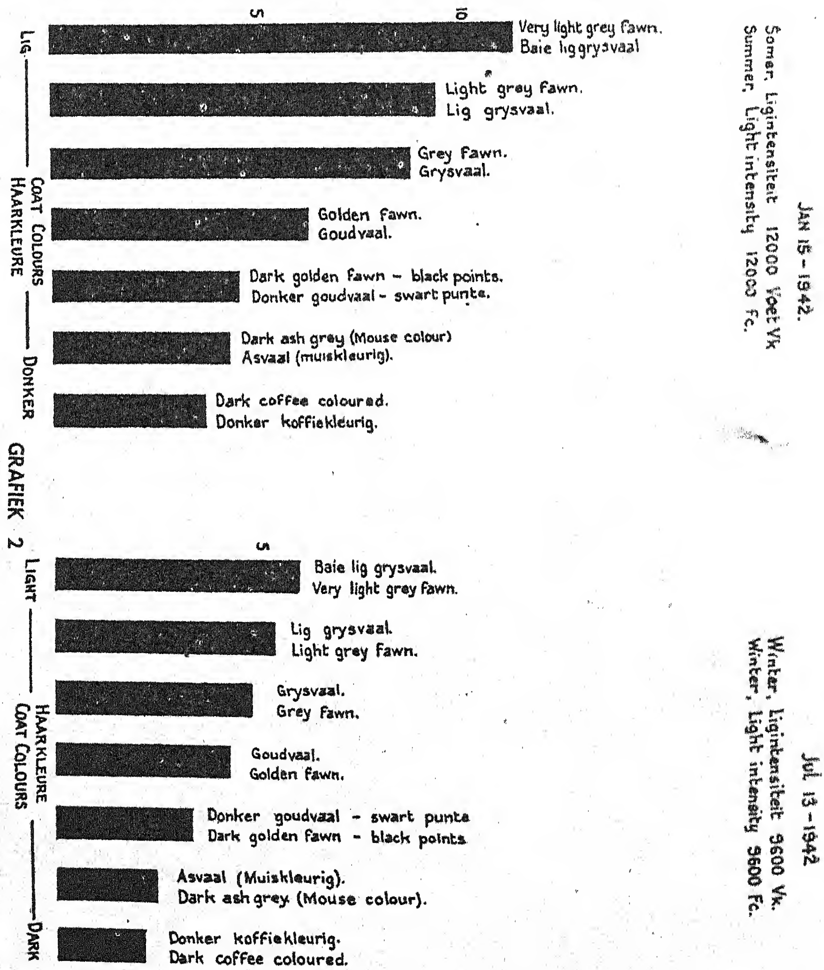
The writers wish to thank all those who assisted in this work, especially Messrs, P. J. Haasbroek. and J. F. G. Badenhorst of the Messina Experiment Station for the making of observations on the test animals and for assistance in the wearisome task of clipping more than 50 cattle; also the Sheep and Wool Section of the Grootfontein College of Agriculture for taking the hair-thickness measurements; Mr. L. M. Wentzel of the Agricultural Research Institute for the chemical determinations; and the Trigonometrical office, Pretoria for drawing the graphs.



Die Invloed van Haarkleur van Jerseybeeste op die Weerkaatsing van Sonlig.
Reflection of Solar Radiation in Relation to Coat Colour in Jersey Cattle.

Balfour Tvl.

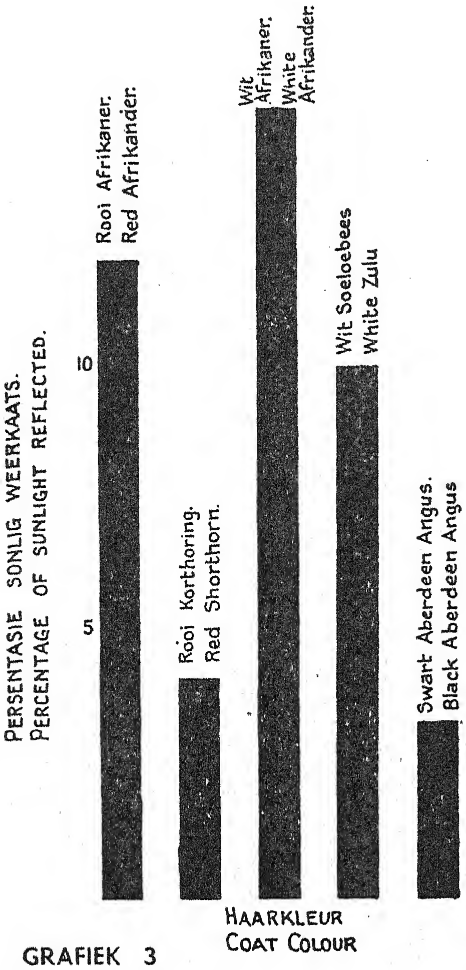
Persentasie sonlig weerkaats — Percentage of sunlight reflected



Grafiek 2
Graph 2

DIE INVLOED VAN HAARKLEUR VAN BEESTE OP DIE WEERKAATSING VAN SONLIG.
REFLECTION OF SOLAR RADIATION IN RELATION TO COAT COLOUR IN CATTLE.

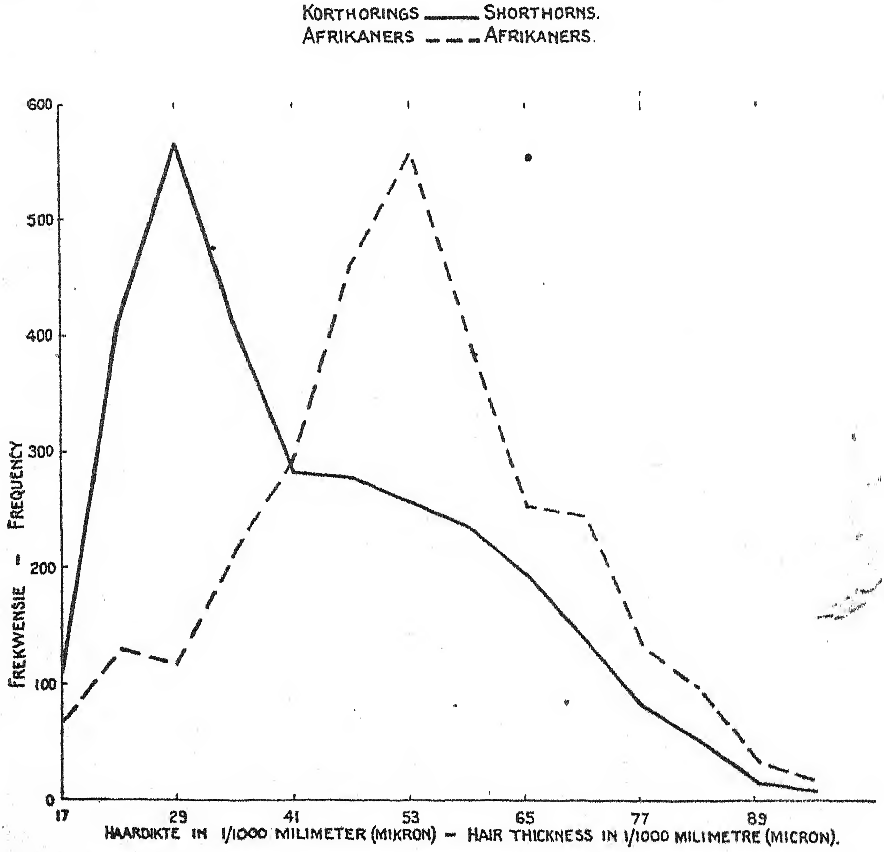
Summer Dec. 1941. Sunlight intensity - 11000 foot candles.
Somer Des. 1941. Sonliq intensiteit - 11000 voetkerse.



GRAFIEK 3
GRAPH 3

FREKWENSIE VERDELING VOLGENS DIKTE VAN HARE VAN KORTHORINGS EN AFRIKANERS.

FREQUENCY DISTRIBUTION OF SHORTHORN AND AFRIKANER HAIR ACCORDING TO THICKNESS.



GRAFIEK 4
GRAPH 4

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 FEBRUARY 1943 No. 246

CONTENTS

* Price Review for December, 1942.

SLAUGHTER STOCK.—Consignments of slaughter stock to the Johannesburg market during December were more moderate than for the previous month. The market opened on a lower basis than the high level for November but a sharper demand during the Christmas and New Year period caused prices to rise again. The average prices for the month, however, for all classes were lower than for November, especially in the case of primes. Ordinary primes were 69s. 4d. per 100 lb. estimated dressed weight *on the hoof* as against 78s. 2d. for November, good medium were 64s. 3d. as against 69s., and compounds 51s. 1d. as against 52s. 2d. On the Durban market, grade 3 cattle showed a rise from 47s. 6d. per 100 lb. dressed weight *on the hook* to 51s. 11d. for December, while undergrade declined from 38s. 7d. to 35s. 11d.

Slaughter sheep on the Johannesburg market also showed a decline in prices compared with the previous month. Prime merinos for example, fell from 12·9d. per lb. estimated dressed weight *on the hoof* in November to 12·3d. in December, and prime crossbreds from 11·6d. to 10·3d. Lambs realized good prices, especially before Christmas. Goats, however, also declined considerably compared with the previous month. On the Cape Town market, slaughter sheep, however, were generally higher than during November. Prime merinos rose from 10·5d. per lb. to 10·9d., and prime crossbreds from 10·4d. to 10·8d.

Hay.—A relatively heavy supply of lucerne hay reached the markets, but owing to the fact that other types of hay were scarce, especially oat hay, sweet grass and teff grass, prices remained high.

* All prices mentioned are average.

Dry Beans and Dry Peas.—Moderate offerings of dry beans and small quantities of dry peas experienced a strong demand. On the Johannesburg market, kaffir beans were 22s. 7d. per bag, and speckled sugar beans 37s. 3d. per bag.

Potatoes.—Exceptionally large supplies, especially of locally produced potatoes, were present on all markets, so that in most cases the supply exceeded the demand. As a result prices again declined sharply everywhere. On the Johannesburg market for example, Transvaal No. 1 dropped from 16s. 10d. per bag in November to 11s. 6d. in December, and National Mark Grade 1, No. 2, from 18s. 3d. to 14s. 1d. On the Cape Town market the drop for Cape No. 1 was 18s. 10d. per bag to 12s. 2d., and for Natal No. 1 on the Durban market it was 21s. 4d. to 15s. 6d. respectively.

Onions.—In this case too, supplies increased appreciably on all markets and price declines occurred everywhere. On the Johannesburg market Transvaal onions were 9s. 3d. per bag for December as against 11s. 11d. for November and Cape onions on the Cape Town market realized 11s. 9d. as against 17s. 10d.

Tomatoes.—Supplies of Transvaal tomatoes began to diminish on the markets towards the end of the month and prices, especially of good quality, improved greatly so that the average prices for the month were on the whole higher than for the previous month. National Mark tomatoes on the Johannesburg market were 3s. 8d. per tray for December, while ordinary tomatoes were 3s. and 2s. 4d. per tray on the Cape Town and Durban markets, respectively.

Vegetables.—Good to moderate supplies of green mealies, cabbage cucumbers and squashes, especially of local origin, were present on the markets. Green beans and green peas were scarcer and sold at excellent prices.

Fruit.—Consignments of deciduous fruit increased appreciably, especially apricots, and afterwards peaches and plums. Prices were lower than for November but were still very satisfactory. Large supplies of watermelons and sponspeks also reached the market and in this case too, prices in general declined during the month. Small supplies of the new season's apples also started to come in. Supplies of citrus fruit began to diminish but were still well supplied, and enjoyed an excellent demand. As regards tropical fruit, the mango season was in full swing, while pawpaws and grenadellas were also exceptionally plentiful. Prices, however, were firm.

Eggs and Poultry.—The supply of eggs diminished during the month and, in addition, the demand rose, especially as a result of the higher consumption during Christmas and New Year period. Prices consequently rose everywhere. New-laid eggs on the Johannesburg market, for example, were 1s. 8d. per dozen for December as against 1s. 5d. for November, and on the Durban market 2s. per dozen as against 1s. 7d. Slaughtered and live poultry were heavily supplied but the Christmas demand was exceptionally strong and excellent prices were realized.

Prices of Groundnuts for 1943.

As a result of the drought, the groundnut crop during the past season (1941-42) was exceptionally small. The Union's groundnut requirements for oil expressing purposes have increased appreciably during the past few years, while it is at present also much more

difficult to import supplies. The Food Controller therefore bought the whole crop from producers in order to ensure that an adequate supply is being retained for seed purposes.

During the past few years, an agreement was entered into each year in April between producers and the oil expressers, whereby the latter undertake to buy from producers at a fixed price the quantities which are available for oil expressing purposes and which do not enter the local trade for edible consumption. The price agreed upon since 1935 for 100 lb. shelled nuts was as follows:—

1935—13s. 3d.; 1936—14s.; 1937—16s.; 1938—16s.; 1939—15s. 6d.; 1940—18s.; 1941—20s.

Since it is in the national interest that the production of groundnuts should be stimulated to the maximum extent, the Food Controller has, in consultation with the bodies responsible for the price fixation in the past, as well as with the Price Controller, now decided to indicate to producers in advance what price they can expect for that part of the crop which will be available for oil expression during 1943. The Food Controller has therefore announced that arrangements will be made with the Controller of Soaps and Oils for the purchase of shelled groundnuts out of the 1943 crop at £27. 10s. per ton shelled (in bags), senders' stations, for Q 2 quality nuts. This means a price of 27s. 6d. per bag of 100 lb. shelled which corresponds to a price of approximately 16s. to 17s. per bag of 100 lb. unshelled. This price applies only to groundnuts which will be used for oil expressing purposes. For groundnuts which will be used for edible purposes, higher prices should be realized. The average price which producers will receive should therefore be well above the price agreed upon.

Arrangements in regard to the disposal of the 1943 crop will be announced later.

Index for Prices of Field Crops and Pastoral Products.

As is shown elsewhere, this index declined during December, namely from 147 in November to 144. The most important price declines occcurred in the following groups:—

(*a*) Slaughter stock from 187 to 178 in December. This is the first time since April, 1942, that the index of slaughter stock has experienced a decline.

(*b*) Hay from 134 to 123.

(*c*) Other field crops (i.e. potatoes, onions, sweet potatoes and dry beans) from 187 to 137 in December.

The only advance occurred in the group "Poultry and Poultry Products" where the excellent prices realized by eggs and poultry during the month caused the index to rise from 146 in November to 158 in December.

The 1942-43 Argentine Fruit Crop.

ACCORDING to the first official estimate it appears that an extraordinary large fruit crop is expected in the Argentine for the 1942-43 season.

The following yields for the respective fruits are expected:

	Ton.
Cherries	7,400
Plums	20,300
Apricots	10,300
Peaches	111,700
Apples	108,400
Pears	115,200
Table Grapes	227,200
Quinces	15,700

Especially in the case of peaches an exceptionally large crop is expected, viz. an increase of 116 per cent. above that of the previous season. Other particularly large increases that are expected above that of the previous season are in the case of pears, viz. 83·7 per cent., plums, 80 per cent., and apricots, 69·4 per cent.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39 = 100.)

SEASON (1st July to 30th June).	Summer Cereals, (*a*)	Winter Cereals. (*b*)	Hay. (*c*)	Other Field Crops. (*d*)	Pastoral Products. (*e*)	Dairy Products. (*f*)	Slaughter Stock. (*g*)	Poultry and Poultry Products. (*h*)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936–37..........	118	86	94	93	122	86	89	98	106
1937–38..........	89	106	112	118	98	112	105	107	101
1938–39..........	92	107	96	89	79	102	106	94	93
1939–40..........	86	106	77	93	116	105	106	89	104
1940–41..........	109	113	106	159	103	108	110	112	109
1941–42..........	121	132	145	205	101	131	134	163	124
1942—									
January.......	131	137	126	180	100	122	144	141	125
February......	132	138	125	168	101	130	140	147	125
March.........	126	140	140	175	101	130	134	168	125
April..........	126	139	151	170	102	130	129	175	125
May...........	158	139	188	181	102	154	132	203	136
June..........	159	139	207	186	101	154	140	218	138
July..........	159	140	183	184	166	167	154	163	143
August........	159	139	181	175	115	167	155	130	140
September.....	159	139	182	191	115	167	176	133	145
October.......	159	139	156	227	115	167	181	141	147
November.....	160	154	134	189	115	139	187	146	147
Desember.....	160	154	123	137	115	139	178	158	144

(*a*) Maize and kaffircorn.
(*b*) Wheat, cats and rye.
(*c*) Lucerne and teff hay.
(*d*) Potatoes, sweet potatoes, onions and dried beans.
(*e*) Wool, mohair, hides and skins
(*f*) Butterfat, cheese milk and condensing milk.
(*g*) Cattle, sheep and pigs.
(*h*) Fowls, turkeys and eggs.

Average Prices of Apples, Pears and Grapes on Municipal Markets.

SEASON (1st July to 30th June).	APPLES (Bushel box).						PEARS (Bushel box).		GRAPES (Tray).
	Johannesburg.			Cape Town.			Johannesburg.		Johannesburg.
	O'heni-muri.	White Winter Pear-main.	Wem-mers-hoek.	O'heni-muri.	White Winter Pear-main.	Wem-mers-hoek.	N.M. No. 1.	Other.	Johan-nesburg.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	7 2	6 0	5 10	7 3	8 0	4 3	6 7	4 2	1 3
1940–41	8 4	7 1	6 4	8 11	10 8	5 7	8 11	6 3	1 8
1941–42	8 11	7 11	7 3	9 1	10 9	6 9	7 3	8 0	1 11
1942—									
January	—	—	—	—	—	—	—	7 5	3 2
February	8 3	—	12 2	8 10	—	—	7 3	7 8	1 6
March	7 5	6 11	7 6	7 7	9 3	6 3	5 6	7 0	1 10
April	8 6	7 6	6 8	7 9	9 8	6 2	—	9 6	1 11
May	8 10	7 7	6 5	8 9	9 7	5 6	—	8 11	2 0
June	10 1	8 10	8 4	9 7	10 9	6 3	—	15 9	2 5
July	11 2	11 4	8 1	10 10	12 1	8 11	—	—	0 10
August	17 6	15 8	10 6	11 7	11 8	9 10	—	—	—
September	16 4	16 3	7 0	11 11	11 3	—	—	—	—
October	16 6	16 3	—	9 11	9 4	—	—	—	—
November	20 8	18 6	—	10 4	7 2	—	—	—	—
Desember	19 7	17 8	—	11 10	17 5	—	—	—	3 8

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

SEASON (1st July to 30th June).	GREEN BEANS (Pocket 20 lb.).			GREEN PEAS (Pocket 20 lb.).			CARROTS (Bag). (a)		
	Johan-nesburg.	Cape Town.	Durban.	Johan-nesburg.	Cape Town.	Durban.	Johan-nesburg.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 1
1940–41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	13 4
1941–42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 6
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	19 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 6	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 9	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	6 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

Average Prices of Potatoes and Onions on Municipal Markets.

SEASON (1st July to 30th June).	POTATOES (150 lb.).						ONIONS (120 lb.).		
	Johannesburg.				Cape Town.	Durban.	Johannesburg.	Johannesburg.	Cape Town.
	Transvaal. No. 1.	Transvaal No. 2.	N.M. Grade 1. No. 2.	N.M. Grade 1. No. 3.	Cape No. 1.	Natal No. 1.	Transvaal.	Cape.	Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940-41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December	11 6	9 6	14 1	13 3	12 2	15 6	9 3	10 11	11 9

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

SEASON. (1st July to 30th June).	EGGS.				HIDES (per lb.).		SKINS.		
	Johannesburg.		Cape Town, per 100.	Durban New Laid, per dozen.	Port Elizabeth.		Port Elizabeth.		
	New Laid, per dozen.	Fresh, per dozen.			1st Grade, Sun-dried.	1st Grade, Dry Salted.	Merino. Medium, per lb.	Merino. Combings, per lb.	Glovers, Sound, per skin.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938-39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940-41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941-42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·0	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·5	9·7	3 4

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb.						Pigs per lb. Live Weight.		
	(a) Johannesburg.				(b) Durban.		Johannesburg.		
	N.M. Prime.	Ordinary. Prime.	Good Medium.	Com-pounds.	Medium.	Com-pound.	Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938-39	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940-41	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941-42	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942—									
January	63 2	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
Oktober	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June to 31st May).	Johannesburg.				Cape Town.			
	Merino Wethers.		Persians and Cross Breds.		Merinos.		Capes and Persians.	
	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938-39	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940-41	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941-42	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942—								
January	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March	9·6	8·4	8·8	7·9	9·6	8·8	9·3	8·8
April	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September	12·1	10 5	10·9	9·2	10·1	9·6	10·4	9·4
Oktober	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10 0

* As sold on the hoof. Reported by Meat Control Board.

Average Prices of Lucerne and Teff Hay and Certain Meals for Feeding.

Season (1st July–30st June).	Lucerne (100 lb.). Johannesburg (a). Cape	Lucerne (100 lb.). Johannesburg (a). Transvaal	Lucerne (100 lb.). Cape Town, Cape 1st Grade.	Teff Johannesburg. (a) (100 lb.),	Meals for Feeding: F.o.r. Johannesburg. Lucerne. (100 lb.).	Monkey Nut Cake (200 lb.).	Oats, Sussex Ground (150 lb.).	Bone, 24·8% (Protein 00 lb.).	Mixed, 26·4% Protein (100 lb.). (b)
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	3 11	3 1	4 0	2 7	6 9	15 2	15 4	8	8 0
1940–41	4 2	3 5	4 3	3 3	6 7	15 3	14 8	11 5	8 7
1941–42	5 7	5 2	5 8	4 7	8 4	—	17 5	10 12 1	10 10
1942—									
January	4 10	4 7	5 1	4 11	7 6	—	17 6	10 [illegible]	10 3
February	4 11	4 8	5 5	4 4	7 6	—	17 6	10 6	10 8
March	5 4	4 11	5 7	5 6	8 6	—	17 6	11 [illegible]	10 3
April	5 8	5 6	5 9	6 4	8 6	—	17 6	11 [illegible]	10 3
May	7 5	6 11	6 7	6 6	9 6	—	18 0	11 0	15 9
June	8 1	7 7	7 9	7 4	9 6	—	18 0	11 0	15 9
July	7 3	6 4	7 10	6 1	9 6	—	18 0	—	16 6(c)
August	7 4	6 4	7 10	5 5	9 6	—	18 0	—	16 6
September	7 5	6 3	7 5	5 3	9 6	—	18 0	—	16 6
October	6 3	6 7	7 1	5 0	9 6	—	18 0	—	18 9
November	5 1	4 0	6 4	5 5	9 6	—	18 0	—	18 9
December	4 11	4 5	7 1	3 11	9 6	—	18 0	—	18 9

(a) Municipal Market. (b) Approximately half of the protein is claimed to be animal protein. (c) Per 150 lb.

Average Prices of Maize, Kaffir-corn and Dry Beans per 200 lb.

Season and Month.	Maize. F.o.r. Producers' Stations. No. 2. Bags.	Maize. F.o.r. Producers' Stations. No. 2. Ex Elevator.	Maize. F.o.r. Producers' Stations. No. 6. Bags.	Maize. F.o.r. Producers' Stations. No. 6. Ex Elevator.	Maize. Cape Town Consumers' Price F.o.r. No. 6 in Bags.	Kaffircorn F.o.r. Producers' Stations. Bags, K. 1.	Kaffircorn F.o.r. Producers' Stations. Bags, K. 2.	Dry Beans Johannesburg (Municipal Market). Speckled Sugar.	Dry Beans Johannesburg (Municipal Market). Cow Peas.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	8 7	8 6	8 6	8 8	13 2	13 1	12 9	25 0	16 9
1940–41	9 2	8 8	9 3	8 9	14 0	15 6	17 0	30 0	16 8
1941–42	—	—	—	—	—	—	—	32 10	19 8
1941—									
January	9 9	8 11	9 9	9 0	14 1	24 3	23 0	35 3	14 11
April	10 3	9 8	10 8	10 0	14 11	14 3	15 8	33 2	18 6
July	9 3	—	9 1	—	13 7	17 4	17 10	34 8	21 9
October	10 10	9 11	9 10	8 10	13 11	17 3	18 1	34 6	20 10
1942—									
January	11 0	10 1	10 10	9 4	14 9	21 5	22 3	34 4	21 9
February	11 0	—	11 0	—	14 8	21 11	22 11	32 7	20 11
March	10 6	—	10 6	—	14 9	20 2	21 1	30 10	19 2
April	10 6	—	10 6	—	14 10	18 5	18 9	32 6	25 5
May	15 0	—	15 0	—	15 6	20 8	20 8	32 8	26 4
June	15 0	—	15 0	—	17 6	21 11	21 11	33 5	26 5
July	15 0	—	15 0	—	17 7	21 8	21 8	33 7	24 8
August	15 0	—	15 0	—	17 8	22 10	22 10	36 7	27 2
September	15 0	—	15 0	—	17 7	24 6	24 6	38 1	28 4
October	15 0	—	15 0	—	17 9	24 8	24 8	39 0	27 6
November	15 0	—	15 0	—	17 10	25 0	25 0	38 6	27 1
December	15 0	—	15 0	—	17 11½	25 0	25 0	37 3	22 7

Seasonal year for maize and kaffircorn, 1st June–31st May; for dry beans, 1st April–31st March.

SPECIAL PRODUCTION NUMBER
(Winter Rainfall Area).

◆ ◆ ◆

CONTENTS

[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Information on Departmental Publications.

Farming in South Africa, the monthly journal of the Department, contains popular as well as scientific articles on a variety of agricultural topics, useful to both the farmer and the housewife, while the **Crops and Markets** Section, supplies information on crop prospects, market prices and exports of agricultural produce.

The following particulars in regard to subscriptions and advertisements should be noted:—

Subscription.—Within the Union, South West Africa, Bechuanaland Protectorate, Southern Rhodesia, Swaziland, Basutoland, Mocambique, Angola, Belgian Congo, and British Territories in Africa 5s. (otherwise 7s. 6d.) per annum, post free, payable in advance.

Applications, with subscriptions, to be sent to the Government Printer, Koch Street, Pretoria.

Advertisements.—*The Tariff for Classified Advertisements is:* 2d. (two pence) a word with a minimum of 5s. per advertisement (prepaid). Repeats, not entailing any change in the wording, will be published at half the cost of the original.

Conditions:—

(1) The advertisement will be classified under specific headings, and only one black letter (initial letter) is permitted.
(2) Advertisements in which prices are mentioned must contain the name and address of the advertiser. A nom-de-plume or box number only is not sufficient, and unless this condition is strictly observed advertisements will not be accepted.
(3) Advertisements will be classified strictly in accordance with the subject-matter of the announcement, determined by the first item mentioned, and cannot be inserted under irrelevant headings.
(4) Displayed, classified advertisements will also be accepted. The charge however, will be 15s. per inch, single column, per insertion, without reduction for repeats

Copy for Advertisements to be in the hands of the Government Printer, Pretoria, not later than the 20th of the month preceding publication.
Send all advertisements direct to the Government Printer, or write to him for details as to tariff for advertisements.

Popular Bulletins.—Bulletins on various agricultural topics are published by the Department to meet public demand. A list of available bulletins giving particulars of cost, etc., is obtainable free of charge from the Editor, Department of Agriculture and Forestry, Pretoria.

Scientific Publications.—From time to time the different Divisions of the Department issue science bulletins incorporating the results of research work conducted by them. Other scientific publications issued are: "The Onderstepoort Journal", "Memoirs of the Botanical Survey of South Africa", "Bothalia", "Entomological Memoirs" and the "Annual Reports of the Low Temperature Research Institute". Information in regard to these publications is obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Press Service.—The Press of South Africa is now supplied with a bulletin of agricultural information for their exclusive use. This information is published fortnightly by all newspapers and other journals throughout the country.

Farmer's Radio Service.—In addition to the printed information supplied by the Department to members of the farming community, the Department, in collaboration with the South African Broadcasting Corporation, also maintains a daily broadcasting service to farmers. Information in regard to times of broadcasting is contained in the programmes issued by the Broadcasting Corporation.

Inquiries.—All general inquiries in regard to the publications of the Department, including the Radio Service, should be addressed to the Editor, Department of Agriculture and Forestry, Pretoria.

D. J. SEYMORE, Editor

Special Production Number

Foreword by Prof. W. J. Pretorius, Acting Principal, Stellenbosch-Elsenburg College of Agriculture.

WHEREAS the October (1942) *issue of* Farming in South Africa *was devoted mainly to production problems in the summer-rainfall area, this issue is devoted exclusively to the various aspects of food production in the winter-rainfall area. Some articles are, however, of general interest and it is hoped that producers throughout the country will read this issue attentively if only to become better acquainted with our special conditions.*

The production season of many crops in this area commences or reaches its peak when the production season in the summer-rainfall area has either come to an end or reached its lowest point. In many respects this is a great advantage since the two main areas are therefore complementary and consumers are more or less assured of a regular supply of products.

Where, a few years ago, the producer often experienced difficulty in selling his products, we find that the marketing problem has suddenly changed into a production problem. So, for example, it has already become necessary to ration fertilizers. Not only are the instruments of production now more difficult to obtain, but they are also more expensive. It is therefore necessary for every producer to have the necessary knowledge if he is to derive the greatest benefit from his farming operations. Now is the opportunity for every farmer to safeguard his economic position—an opportunity which may never again present itself.

It is impossible to publish all the articles in one issue and readers are therefore requested to watch the April issue for a continuation of this series.

We therefore hope that producers will find this special issue particularly interesting and instructive.

W. J. Pretorius

Acting Principal.

Tractor Tyres on Sandy Soil.

VERY often tractor tyres develop cracks and ultimately blow out when the tread is still in excellent condition. The reason for this is that farmers allow their tractors to do extra heavy work in sand and as soon as the wheels begin to spin they let the air out to reduce the pressure in the tyres.

In view of the high cost of tractor tyres and the scarcity of rubber, it is in the interest of every farmer to use his tyres in such a way as to get the maximum use out of them. The wheels of the tractor will begin to spin sand as soon as the load becomes too heavy. It is quite wrong, therefore, to reduce the tyre pressure instead of reducing the load. It is extremely detrimental to the tyres to use them while they are only partially inflated. The pressure on the side-walls is increased with the result that the tyres are over-taxed and eventually burst.

The tyres should, if possible, not be exposed to direct sunlight. If a tractor must be left in the sun, e.g., while driving a threshing machine, it is advisable to cover the tyres with old bags or some other covering.

Extra Weight in Tyres.

The Controller of Transport has furnished the following suggestions:—

Water or special solutions, as recommended by the tyre companies can, with advantage, be pumped into tractor tyres. The water settles at the base of the tyre and the additional weight increases adhesion between the tyre and the ground. Weights may also be added to the wheel rims to produce a similar result. Both methods tend to reduce wheel-spin. In extreme cases non-skid chains can be used to reduce wheelspin.

Normally, irrespective of tyre size, the most satisfactory pressures to maintain in the tyres are:—

Front tyres, 4 ply ...	28 lb.
Front tyres, 6 ply ...	36 lb.
Rear tyres, minimum ...	12 lb.

When tyres are loaded by weights or water, the air pressure should be increased by 2 lb. per square inch for each 150 lb. added. The maximum pressure in the rear tyres should not exceed 12 lb. per square inch.

(O. S. Heyns, Extension Officer, Piketberg.)

Reprints.

(Obtainable from the Division of Chemical Services, Pretoria.)

No. 19 of 1940.	Fertilizer problems in vegetable production ...	—
No. 19 van 1940.	Bemesting vraagstukke in verband met groente verbouing ...	—
No. 53 of 1941.	Lime for agricultural purposes ...	—
No. 53 van 1941.	Kalk vir landboudoeleindes ...	—
No. 73 of 1941.	Compost ...	—
No. 73 van 1941.	Kompos ...	—
No. 90 of 1941.	Bat manure ...	—
No. 90 van 1941.	Vlermuismis ...	—
No. 19 of 1942.	The new fertilizer mixtures ...	—
No. 19 van 1942.	Die nuwe kunsmismengsels ...	—

A Sound Farming Policy for the South-Western Districts.

N. L. Smit, Extension Officer, Riversdale.

ACCORDING to the regional classification of the Wheat Commission the South-Western Districts include the area to the south of the Langeberg, viz., the districts of Swellendam, Heidelberg, Riversdale and the western portion of Mossel Bay. This area can, however, be sub-divided into three ecological areas, namely, the dune area, the grain-growing area and the mountain area. Only the grain-growing area will be discussed here.

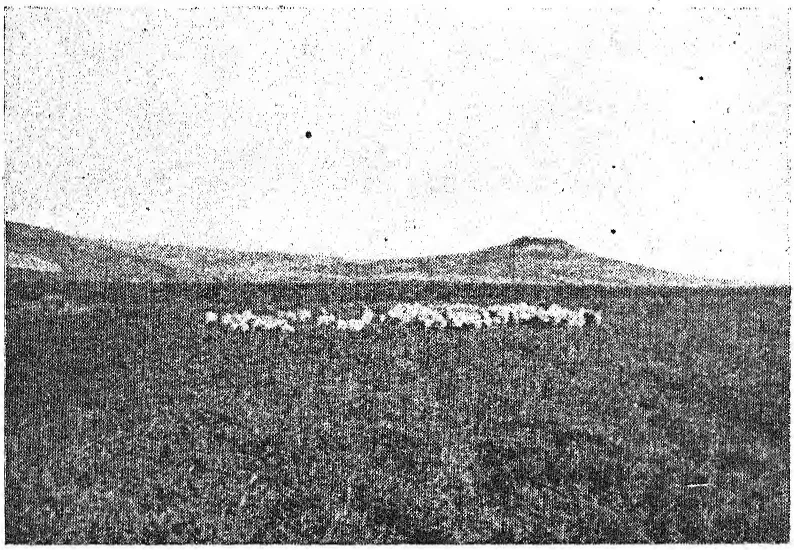


Fig. 1.—Rhodes grass provides valuable grazing in the South-Western Districts.

Soil and Climate.

The soils in this area are derived mainly from Bokkeveld shale, locally known as "nabank". In many places the shale appears on the surface but in some places it is covered with a shallow layer of gravel and in others with a reddish clay loam. In the Riversdale-Heidelberg flats ("vlaktes") the shale is covered with a fairly deep layer of loam, presumably an alluvial deposit.

The average annual rainfall varies from 12 to 18 inches of which 45 per cent. to 55 per cent. falls during the summer months. The average total as well as the summer rainfall increases from west to east and also from south to north. Over the greater part of this area March and October are the wettest months, while the rainfall is relatively low and very irregular during the months of June, July and August. During the winter months there are also the hot, dry mountain winds which have a surprisingly desiccating effect on all plant growth. The sky is also overcast during the greater part of spring and early summer, and this type of weather is accompanied by a gradual increase in the air and soil temperature. The wheat farmer therefore has to contend with very unfavourable conditions, viz., dry winters which retard plant growth and encourage wheat-lice infestation, a cool, overcast and sometimes wet spring and an

early summer which favour the development of fungus diseases like rust, etc., and heavy rains which sometimes cause considerable damage during the harvesting period. The safest area for wheat is the south western corner, namely that between Swellendam, Riviersonderend and Protem, mainly owing to the more favourable distribution of the rainfall.

Natural Vegetation.

In 1803 the area between Swellendam and Heidelberg was described as "completely covered with a dense carpet of grass". There is every reason to believe, however, that the whole area under discussion was at one time similarly covered with grass, mainly *Themeda triandra* (a red grass locally called "blougras"). Everywhere traces of good grazing grasses like *Themeda triandra* and species of *Digitaria, Panicum, Ehrharta,* etc., are still to be seen, but these have largely disappeared as a result of veld-burning and over-stocking, and their place taken by rhenosterbush (*Elytropappus rhinocerotis*). Up to about 1930 stock farming was the main industry in this area which was well-known especially for the good wool produced here. As a result of bad veld management, however, the grazing has deteriorated to such an extent that the average rhenosterbush veld can now barely sustain one sheep per 3 morgen. Veld management, especially with a view to restoring the original "blue grass", is now being successfully applied.

Cultivation of Wheat.

Although wheat farming had been practised for some considerable time in the south western corner, it was not until 1930 that farmers really began to concentrate on this branch of farming. During the years 1925-28 there was an average of only 20,000 morgen under wheat in the districts of Swellendam (including Heidelberg), Riversdale and Mossel Bay, but by 1935 the area under wheat had increased to 98,000 morgen, the increase in the Riversdale district alone being from 4,600 to 33,000 morgen during this period. Unfortunately, not only was a large area ploughed which was wholly unsuitable for wheat, but fine grazing was also destroyed in certain parts. In the meantime exploitational cropping in its worst degree occurred, and it was a common occurrence to find wheat planted on the same field three years in succession. Since 1935 there has been a succession of crop failures due to wheat-lice during the dry winters, rust and root rot, while a great amount of wheat has also been damaged by wet weather during harvesting.

Adaptation of the Farming System.

In his comparative study of wheat farming during the crop year 1938-39 Dr. J. C. Neethling stresses the fact that wheat growing is uneconomical in this area. The yield per morgen for that year was regarded as a good average, and yet there was an average loss of £9. 1s. per farm on wheat. Most farmers now realize, however, that their salvation does not lie in wheat, but owing to the low carrying capacity of the farms if the lands are not cultivated, they are virtually compelled to plough the soil in order to obtain ("ouland") grazing for their animals. These ("oulande") become practically worthless for grazing within two years, as a result of the encroachment of numerous shrubs, the most important of which are: rhenosterbush, Klaas Louw bush (*Athanasia sp.*) and ("ouland") bush (*Selago sp.*) The valuable blue grass or rooigras (*Themeda triandra*) does not re-appear on old-lands.

Farming would be more profitable, however, if adapted to ecological conditions, e.g., *by limiting the cultivation of wheat to safe areas and suitable soil, and for the rest by making greater and more effective provision for grazing with a view to economic stock farming.* It is of the utmost importance, especially under the present circumstances where the farmer has to contend with a scarcity of manual labour and a possible shortage of fertilizers, fuel, agricultural implements and spare parts, that he should sow only as much as can be properly cultivated and fertilized, in order to safeguard his crop as far as is humanly possible and to produce economically. Old-lands should be used as effectively as possible to provide grazing for animals and preference should be given to perennial pastures.

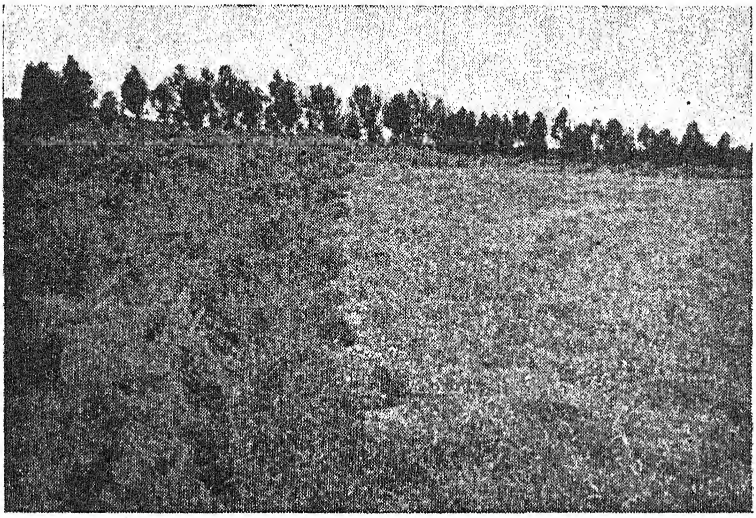


Fig. 2.—Left: Valueless rhenosterbush veld. Right: Rhodes grass.

Pasture Crops.

The following are recommended for this area and briefly discussed:—

Rhodes grass.—This grass can be cultivated economically over the greater part of this area. It has a high carrying capacity, is fairly permanent and will carry 3 to 5 sheep per morgen per year over a period of at least 5 years. It is also drought resistant, keeps shrubs out and gives the best results on gravel and shale soils which are usually the poorest soils for wheat. Rhodes grass can therefore be used as a key crop for utilizing unsuitable and impoverished wheat lands and for economical stock farming.

Subterranean Clover.—Experiments are still in progress with this legume, but the results obtained so far show that it may be used with advantage as protein-rich winter pasture. It is an annual, however, which dies in summer but propagates itself by means of seeds which develop underneath the surface of the soil and germinate after the first rains in autumn. Consequently, if it is properly grazed and not overstocked during the flowering stage in spring, it can be regarded as permanent. On dry lands it gives the best results when mixed with Rhodes grass, and is therefore sown in established grass during March and April, after the first good rain has fallen. If possible, fertilizers should also be applied at the rate of at least 200

lb. super-phosphate per morgen, after which the land should be lightly disced or cultivated and harrowed. A mixture of the early and mid-season varieties of subterranean clover is recommended and should be sown at the rate of 5 to 10 lb. per morgen.

Dry-Land Lucerne.—Unfortunately, lucerne is disappointing in this area; it provides very little grazing and is usually overrun by shrubs within 2 or 3 years. It grows reasonably well on the good wheat lands (loam to clay soil), but very poorly on gravel and shale soils. For that reason it is recommended that lucerne be sown together with winter cereals which are harvested in order to keep costs down and to provide good lucerne "-ouland" grazing for 1½ to 2½ years. Apart from the fact that such a crop will carry 2 to 3 sheep per morgen per year, the lucerne will also increase the fertility of the soil. In good wheat growing areas it should therefore be cultivated in rotation with cereals, as follows:—Wheat, oats (for harvesting) with lucerne, lucerne, lucerne, fallow. The lucerne is sown behind the sowing machine at the rate of 20 lb. seed per morgen and harrowed in. Lucerne can also be sown with Rhodes grass at the rate of 15 lb. per morgen.

Rape.—This crop is drought resistant, nutritious and provides grazing over a long period. Together with a cereal such as oats, it provides valuable winter pasture and will even last until the following summer and autumn. It can even be sown with good results on oat stubble-lands which are left to lie fallow for a volunteer grazing crop. If the soil is still loose, the seed is simply harrowed in, otherwise the field must be lightly disced. Dwarf Essex rape is recommended and should be sown after the first autumn rains, at the rate of 5 to 10 lb. per morgen.

Creeping Salt Bush (*Atriplex semibaccata*).—Widely known as Australian salt bush, was formerly sown for grazing purposes but is now found only in the drier regions where it is regarded as a weed. This crop can provide valuable grazing in summer and in times of drought if it is properly controlled. It should be kept young by periodic heavy grazing or by ploughing it under when it becomes too old or the stand too dense.

Spineless Cactus.—Every farmer should have a few morgen of spineless cactus on his farm as reserve succulent feed in times of drought. It grows best in deep soil along hot slopes or in hot valleys, but brakish soil should be avoided. The soil should be ploughed well in advance of planting, and should be fine and free of weeds. Well wilted leaves are then planted during spring in rows 9 ft. apart, and 6 ft. apart in the rows. Annual inter-row cultivation to keep the soil clean and loose is important. In cold areas a thick layer of straw can be placed between the rows to conserve soil moisture.

Summary.

1. Cultivate wheat only on the best soil and in areas where conditions are favourable.

2. Plant only as much wheat as can be properly cultivated and fertilized.

3. Take full advantage of summer rains by cultivating pastures on old-lands.

4. Reclaim the natural grazing since it is not only the most important potential but also the most economical source of pasturage in this area.

5. Stock farming should be the main source of income and should therefore receive the most attention. Keep good animals and care for them well.

The Sparing Use of Fertilizers by Grain Farmers.

M. H. Slabber, Department of Agricultural Chemistry,
Stellenbosch-Elsenburg College of Agriculture.

THE limited quantity of fertilizers available in our country to-day will in all probability meet only part of the requirements of farmers. Every farmer will, therefore, be compelled to modify his fertilizing programme in order to obtain the greatest benefit from the limited quantity of fertilizer at his disposal. Under these circumstances the grain farmer finds himself in a particularly difficult position since he cultivates annual crops the success of which largely depends on the amount of fertilizer applied every year. The nutrition requirements of winter cereals, especially wheat, are such that these crops cannot be deprived of fertilizer for one or two years and still produce a reasonable yield.

The work of preparing the soil for the 1943 crop was commenced in 1942, and every farmer will do his utmost to sow all cultivated soil despite the limited supplies of fertilizer available. If the grain farmer is to sow on the scale planned last year and still make a success of the crop, he will have to be very economical and judicious in the use of his fertilizer. The following hints are given for his consideration in this connection.

Judicious Application of Fertilizers.

Special attention should be given to those fertilizers which have the most beneficial effect on the crop. So, for example, if an increase in the yield is brought about by the use of phosphate alone on a particular type of soil or in a particular area, it would be advisable to concentrate on the application of phosphate, even to the extent of altogether eliminating the use of nitrogen. If, under these circumstances, an allocation of, e.g. Mixture E has already been made to the farmer, it would be in the general interest for him to mix this with a phosphatic fertilizer so that the dispensable nitrogen could be spread over a larger area and proportionately more of the useful phosphate applied. It should be borne in mind that the application of a fertilizer which is not essential for successful production really means that a fellow farmer is deprived of that fertilizer in an area where its use is extremely necessary. This applies, for example, to the Caledon-Bredasdorp area, where a liberal application of phosphatic fertilizer brings about a good increase in the crop yields, and production does not fall far short of that resulting from the application of the usual fertilizers which also include nitrogen.

On the other hand, there is the Koeberg-Swartland area where the time has long since passed when good crops were obtained by applying phosphate alone. The increase in the yield resulting from the application of nitrogen to-day is greater than or as great as that brought about by the use of phosphate. In this area, therefore, a one-sided phosphatic or nitrogenous fertilizer cannot be recommended since both are necessary, but if a reduction of one of the two must be effected, this should be done at the expense of the phosphate by considerably decreasing but not entirely eliminating the amount customarily used.

Such a reduction can be effected by increasing the nitrogen content of the E Mixture and then using less than the usual amount

of the home-made mixture per morgen. So, for example, two bags of Mixture E may be mixed with one bag of sodium nitrate, but then only one bag of this mixture is applied per morgen instead of, say, the usual two bags of Mixture E per morgen, and the effect will be more or less the same.

What is more effective, however, especially on fine soils which are easily leached, is not to mix the two at all but to use only one bag of Mixture E per morgen at sowing time instead of two bags, and then to broadcast 50 lb. sodium nitrate per morgen just before the grain begins to tiller.

Remember that our choice of nitrogenous fertilizers is at present confined mainly to sodium nitrate which to-day is also an important nitrogenous constituent in our fertilizing mixtures. Sodium nitrate is very soluble in water and is therefore readily leached beyond the reach of the plant roots by heavy winter rains. The result is poor straw growth and a reduction in the grain yield. If, in addition, sodium nitrate is broadcast later on, the chances of leaching and a nitrogen deficiency are greatly reduced.

For the economical use of fertilizers in the border areas or in those areas where variable climatic conditions make the production of normal crops a precarious matter, it is advisable to confine the application of fertilizer to phosphate only, since, under the conditions prevailing in these areas, nitrogen is almost invariably not a limiting factor.

Most Effective Distribution of Fertilizers.

If the supply of fertilizer is insufficient for all the crops on the farm, it is advisable to distribute the limited quantity judiciously over all the crops rather than to fertilize one portion thoroughly and neglect the other entirely.

Treat the poorer soils which react well to fertilizer slightly better than the richer soils. Bear in mind that wheat and barley require much heavier and better balanced fertilizing than oats and rye. Wheat should therefore be cultivated only on the best soil, since its fertilizer requirements are not so exacting. In this connction, the importance of cultivating wheat on wheat lands and not on oat lands cannot be too strongly emphasized. Our supplies of fertilizers are too limited to-day to pamper wheat with fertilizers so that a successful crop may be obtained on soil obviously suited to the production of oats. On oat lands, oats can be produced far more profitably with a limited supply of fertilizer than is possible in the case of wheat.

To obtain the greatest benefit from the application of smaller quantities of fertilizer, the fertilizer should be drilled in along with the seed wherever this is at all possible.

If farm manure is used, it is advisable to apply this to the poorer soils and to supplement the application with 200 lb. superphosphate per morgen. The manure should be applied to the lands as near to ploughing-time as possible or, better still, on the very day of ploughing if sufficient labour is available.

Farmers should bear in mind that good cultural treatment partially compensates for an inadequate application of fertilizer. Consequently, if for any reason some lands cannot be thoroughly loosened during spring, such lands should be fertilized somewhat more heavily. Spring cultivation is particularly important on soils which react well to a nitrogenous fertilizer, but it is only one of the numerous methods of creating suitable conditions for the proper nutrition of plants.

Production of Seed Potatoes.

S. W. Walters, Extension Officer, Worcester.

THE production of seed potatoes is a very intensive and specialized industry. Good seed potatoes should develop true to type and be free from harmful diseases; they should be uniform in shape and size and have been derived from high-yielding disease-free plants. The planting of suitable tubers is absolutely essential for success in the production of good, sound seed potatoes. Deterioration in seed potatoes imported from colder countries is ascribed to unfavourable environmental factors, as well as to exposure of the tubers to diseases which are readily spread.

Selection of Seed Potatoes.—A grower should be on his guard against planting tubers of any description on his land, and should first satisfy himself that the tubers are free from disease. No matter how favourable an area is, potatoes cannot be entirely freed of virus

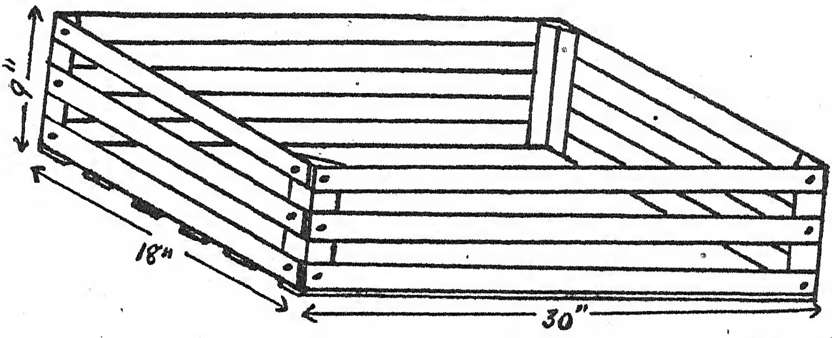


FIG. 1.—A suitable box for sprouting seed potatoes as used by D. Cohen and Sons on the farm "Roggevlei", Ceres.

diseases once they have been infected. Consequently, it is of the utmost importance that seed potatoes should be sound and free from dangerous diseases. Under the Departmental inspection Service tubers intended for seed purposes must weigh at least 1½ oz. each, all smaller and less desirable tubers being rejected. Furthermore, the planting of large, uncut tubers results in the production of a large number of smaller tubers of the very size desired for seed purposes. If such large tubers are cut into three pieces and the pieces planted, each of them will produce a small number of big tubers which are less desirable.

It has been determined generally (i) that cut pieces produce larger tubers but a smaller number than do uncut tubers; (ii) that uncut tubers, are more likely to develop plants than cut pieces; and (iii) that cut surfaces and cut pieces are more susceptible to infection by diseases such as black leg.

Sprouting of Seed Potatoes.

Boxes like those illustrated in Fig. 1, or a well-lighted store-room or loft, are essential for this purpose. A store with a cement floor and sufficient light where frost and rats cannot injure the tubers, is also very suitable.

No seed potatoes should be planted unless they have developed strong, sound sprouts.

From a grower's point of view, the sprouting of seed potatoes has the advantage that foreign varieties can often be identified by the colour of the sprouts, and can therefore be removed. Similarly, unsound tubers can often be detected since they are inclined to form weak sprouts prematurely.

For planting purposes uncut tubers are recommended, but when cutting is necessary the work should be done very carefully so as to leave at least two strongly developed eyes on each cut piece. In Ireland the cutting is done in such a way that the cut pieces remain attached to the original tuber, the portions being separated at planting time and planted consecutively. If such a tuber happens to be infected with some disease all the affected plants grown from it stand close together and can therefore easily be removed. Sometimes the tips of sprouts turn dark or black without any apparent reason and then die off. Frost or any mechanical injury may cause a similar manifestation, which can, however, also occur in the absence of these factors. Investigations have revealed that this manifestation never appears when sprouts are produced in the presence of sufficient light and have developed a short, thick-set structure. A general practice of farmers in the Cold Bokkeveld is to keep tubers weighing as much as 10 oz. for seed production purposes. These tubers are cut lengthwise into three pieces in order to obtain a strongly-developed eyelet on each piece, namely, an eyelet situated on the side opposite to that where the tuber was attached to the rhizome. Boxes containing potatoes for sprouting purposes should be interchanged from time to time so that those in the darker parts can be exposed to more light.

Suitable Areas.

In countries oversea it has already become a general practice to take seed potatoes from high-lying mountainous areas to low-lying parts for seed purposes, whereas the reverse is never done. Investigations have shown that virus diseases are less prevalent in high-lying areas since there are as a rule fewer insects in such localities. A cool, moist area which has a high rainfall and which is exposed to winds is also considered suitable. In short, a windy area with a high rainfall and a cool and humid atmosphere where long intermittent periods of drought are not experienced, is best suited to the production of seed potatoes.

Cultivation Requirements.

A good system of crop rotation is essential. A system extending over a period of four years and longer is recommended, since a successful seed-potato crop should be followed by suitable rotational crops at least once in every four years.

Soil Cultivation.—Experience alone can teach the farmer which method of cultivation is most effective. The aim is to keep the soil loose, open and well aerated, and to complete cultivation between the rows before the plant has reached too advanced a stage of development, otherwise serious damage will be done to the root-system.

Effective ridging to ensure that the tubers are well covered with soil is one of the best methods of protecting them against blight. When the spores of the fungus disease "*Phytophthera infestans*" are washed from the leaves into the soil, the tubers become infected and begin to rot. It is impossible, however, for these spores to penetrate more than 4 inches of soil, so that ridging is a very effective method of protecting tubers against this disease. For the production of a large quantity of small seed potatoes the tubers should be planted somewhat closer together in the rows than is usually done.

Virus Diseases in Potatoes.

The presence of virus diseases in seed potatoes is undoubtedly one of the principal reasons for the rejection of tubers grown for planting purposes. What is a virus disease? Nobody knows. Whereas brown fleck is caused by specific bacteria and late blight by a fungus, it has as yet not been established whether Virus diseases are caused by some visible, or ultra-visible living micro-organism. Their origin is unknown. The various symptoms of virus diseases in plants can best be explained on the supposition that a virus is a living organism, although it is possible that future research may yet disprove this theory.

Planting Potatoes. Cape Flats Experiment Station.

Various viruses attack the potato, but in addition to the seven already known to do so, there are probably others which have not yet been identified and which must still be investigated.

Whatever the nature of a virus may be, virus diseases can be conveyed from a diseased to a healtny plant by sucking insects. The most important transmitter of these diseases is the green aphis (*Myzus persicae*). This insect is mainly responsible for the spread leaf curl and other virus diseases, but there are still other virus diseases which cannot be spread by the insect, the manner in which this happens being still unknown.

It is noteworthy, however, that these diseases do not spread in the absence of insects neither do they occur when there are no diseased plants present, even if insects are about. As a rule, those districts which are free or almost free from diseases are best suited to the production of seed potato. It stands to reason, therefore, that diseased plants should be removed before they can become a source of infection. In practice it generally happens that affected plants have served as a source of infection even before they can be detected. Even volunteer potatoes on adjoining lands may spread the disease so that it is of the utmost importance that all such potatoes should be lifted. On some farms in the Cold Bokkeveld pigs are run on the land after the potatoes have been lifted, so that they can root out the remaining tubers and so prevent the growth of infected volunteer potato plants.

If a virus-infected tuber is planted, all the potatoes produced by that tuber will also be infected. It is in this way that deterioration occurs in any variety.

It is important to note that the occurrence of virus diseases is the main reason why growers in hot dry areas must continually obtain supplies of seed potatoes from colder, moist areas. Under the most favourable conditions plants infected with leaf-curl virus disease cannot possibly yield more than 10 per cent. of the normal crop. As stated above, about seven different virus diseases are known, but it seldom happens that a plant is attacked by two or more at the same time. What makes the position so difficult, however, is the fact that each virus disease has different symptoms and that some reveal no external symptoms at all. A plant infected may carry such virus diseases, without any outward indications of their presence. Virus diseases are spread by insects not only on the lands but also in the boxes where the tubers are kept for sprouting. Insects which feed on the sprouts of potatoes can easily spread viruses from infected to healthy tubers in boxes where they are sprouting.

The following methods may be adopted for the prevention of potato diseases:—

(1) Plant clean, healthy tubers obtained from a reliable source.

(2) Allow potatoes to sprout before planting them.

(3) The crop should be planted a good distance away from other potato lands, and from other solanaceous and brassicaceous or cruciferous crops; that is, not within 100 yards of such crops.

(4) Do not leave infected tubers lying about on the land or even throw them on the rubbish-heap. Collect all infected tubers and boil them.

(5) Do not cover lifted tubers on the land with potato foliage.

(6) Follow a good system of rotational cropping and allow the longest possible period to elapse between successive potato crops.

(7) Remove isolated infected plants as soon as they are detected.

The following are a few of the commonest virus diseases:—

(1) *Leaf curl.*—Potato plants infested with leaf-curl virus disease are usually stunted and sometimes grow erect. The leaves are rolled and thickened, with a leathery texture, and produce a metallic sound on being shaken. The crop yield is greatly diminished and sometimes, but not always, the vascular bundles die off and become dark brown—a condition known as net necrosis.*

As a rule, the lower leaves are the first to show symptoms of leaf curl, their appearance being not unlike that of leaves which have been parched by hot weather, but with this difference that leaves infected with leaf curl assume the characteristic thickened leathery texture.

Leaf curl assumes a primary and a secondary stage. The former, which is only a mild degree of infection, appears a month after the disease has been transmitted by insects from affected plants to healthy plants. In this stage leaf curl can easily be confused with another disease caused by the fungus "*Rhizoctonia solani*" which produces similar symptoms. It is the secondary state of leaf curl, however, which severely affects the crop yield. As in the case of other virus diseases, this condition can be prevented and localized by timely roguing of the affected plants.

* The word "Necrosis" is derived from the Greek word "Nekros" meaning a dead body, and is used to denote the dying of a certain part of the plant.

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The Cultivation of Winter Cereals.

Fallowing of Lands and Choice of Varieties.

Dr. P. D. Henning, Senior Lecturer in Field Husbandry,
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IN the winter-rainfall area wheat is sown almost exclusively on fallowed lands, which are usually ploughed in July or August. If the lands are very uneven, they are sometimes levelled with a drag during summer in order to break up all clods. Sometimes the fallowed lands are harrowed after a rain during the summer months. Apart from this treatment, however, very little or no attention is given to the cultivation of ploughed lands.

Cultivation of Fallowed Lands.

Experiments carried out at this Institution show that the cultivation of ploughed lands in spring and in autumn undoubtedly results in an increase in the grain yield. At the Langgewens Experiment Station the following cultural treatments, among others, were carried out every year alternately on two pieces of fallowed land over a number of years.

Treatment 1.—The stubble-land was ploughed in July to a depth of approximately 9 inches. No further treatment was applied before the following year in May, when fertilizer was broadcast, the ground ploughed to a depth of approximately 6 inches, and the soil planted with a disc seed-drill. This corresponds more or less to the practice followed by a large number of farmers.

Treatment 2.—The soil is treated in exactly the same way as described under Treatment 1, except that the fallowed lands are again loosened to a depth of approximately 6 inches with a cultivator during September or October.

Treatment 3.—The same as described under Treatment 1, except that during March the fallowed lands are again loosened with a cultivator to a depth of approximately 6 inches.

Treatment 4.—The same as described under treatment 1, except that during September or October the fallowed lands are again loosened to a depth of approximately 6 inches with a cultivator, the treatment being repeated in March.

In Table I the yields in bags per morgen are given for the various treatments during the seasons 1933 to 1938. (Since the results for 1935 were not significant, the figures for that year are omitted.)

TABLE I.—*Wheat yields in bags per morgen.*

Season.	Treatment 1. (No cultivation.)	Treatment 2. (Spring cultivation.)	Treatment 3. (Autumn cultivation.)	Treatment 4. (Spring and autumn cultivation.)
1933	11·9	12·4	12·7	13·9
1934	15·1	17·1	15·7	16·9
1936	6·6	10·8	7·6	11·7
1937	8·5	10·4	10·5	11·6
1938	8·8	11·6	10·4	12·0
Average	10·2	12·5	11·4	13·2

This experiment was repeated in 1939 and 1940, but couch-grass (kweek) became so troublesome that it was necessary to plough all dry fallowed lands during February in 1939 and 1940. During both these years no rain fell before March, and as the soil was still loose in March, no cultivator treatments were applied. For all practical purposes, therefore, this means that treatments 1 and 3, and 2 and 4, respectively, were the same during the above two seasons. The results are given in Table II.

TABLE II.—*Wheat yields in bags per morgen.*

Season.	Treatment 1.	Treatment 2.	Treatment 3.	Treatment 4.
1939..................	7·7	10·4	7·6	10·5
1940..................	8·0	10·2	8·2	10·0
Average..............	7·9	10·3	7·9	10·3

Discussion of Results.

The results in Table I indicate that where fallowed lands were cultivated both in spring and in autumn, the average yield was 29 per cent. higher than in the case of fallowed lands which received no cultivator treatment. Where lands were treated only in spring, the average yield was increased by 23 per cent., while the yield was increased by 12 per cent. where lands were cultivated only in autumn. In 1939 and 1940 treatments 1 and 3 were the same, as also treatments 2 and 4. The latter two treatments were applied in spring, but not the former. According to Table 2 the spring cultivator treatment increased the yield by approximately 30 per cent.

It is noteworthy that the effect of the various cultural treatments differs from season to season. In 1933 and 1937, for example, there was practically no difference between the yields obtained from fallowed lands which were cultivated only in September and those cultivated only in March. In 1936, however, the September treatment, as compared with the March treatment, brought about an increase of about 42 per cent. in the yield. This apparent inconsistency must be ascribed to the conditions of the soil when it is cultivated. In September and October the soils are always still comparatively moist, and spring cultivation invariably produces favourable results. During March the soils are frequently very dry, and this explains why the effect of the autumn cultivation is sometimes less favourable than that of the spring cultivation. In 1934, and particularly in 1936, the soil was very dry when it was cultivated in March. During these years the results of the autumn cultivator treatment were comparatively unfavourable. In 1933 and 1937 the soil was fairly moist in March. Indeed, in the latter year the treatment was carried out after a rainfall of approximately 1¼ inches. In that year the effect of the autumn cultivations was practically the same as that of the spring treatments. The results given in Table I also reveal that the favourable effect of the cultural treatment of fallowed land, especially the spring cultivation, is much greater in unfavourable seasons than in favourable seasons.

At the Jongensklip Experiment Station similar results were obtained. In addition, the results also showed that cultural treatment during September with a disc harrow and plough gave just as good results as the cultivator treatment.

Recommendations.

At a liberal estimate, the cost of treating fallowed land with the cultivator is 6s. per morgen. It therefore pays the farmer well to cultivate his fallowed lands every year in spring. The ruling prices for wheat also make it profitable to cultivate lands for a second time in autumn, provided good rains have fallen in February or March.

The beneficial effect of cultivator treatment is probably due to the increase of available nitrogen in the soil. Cultural treatment results in better aeration of the soil, the nitrification process is accelerated and more nitrogen made available. The fact that the best results are obtained when the soil is moist, appears to confirm this surmise.

In view of the possible shortage of fertilizers, especially nitrogenous fertilizers, farmers are advised to cultivate their fallowed lands thoroughly in an effort to counteract the adverse effect of the present shortage.

Grain Varieties Suited to the Winter-rainfall Area.

One of the most important requirements in the economic production of cereals is to sow varieties adapted to local conditions. The following varieties of wheat, oats and barley are recommended.

Wheat Varieties.

Sterling.—No other wheat variety is so popular and so generally cultivated as Sterling. It has a bearded ear with a brown grain. It grows, tillers and yields well, and does not shatter readily. This variety has excellent baking qualities and, consequently, falls under Class A. Its principal weakness is that it is not resistant to rust. In spite of the fact that Sterling has escaped serious damage by rust during the last few seasons, farmers are warned not to sow this variety alone, as they have been doing here and there. Sterling can be recommended for the whole winter-rainfall area, except the south-western districts.

Koalisie is a bearded wheat with a white grain. It matures early, tillers and grows reasonably well, has a straw of medium strength and does not shatter readily. It has poor baking qualities, however, and falls under Class B. Koalisie is characterised by its resistance to drought and rust, being, in fact, one of a most highly rust-resistant varieties at the moment. Although Koalisie will not produce the same yields as Sterling in favourable rust-free years, it is a safe wheat to grow owing to its rust-resistance, and can, therefore, be recommended for the whole winter-rainfall area. In its present form, this variety is not yet quite pure, but efforts are being made at this Institution to get it true to type, and seed will then be made available.

Renown is a selection from a variety of the same name imported from Canada. The ear is white and beardless, and the grain dark brown. Renown matures early, has a strong straw and does not shatter readily. A characteristic of this variety is its high degree of resistance to the prevailing forms of rust. It has good baking qualities and falls under Class A. About two years ago seed of this variety was made available to farmers for the first time. Hitherto Renown has given very good results in the Caledon, Bredasdorp and Swellendam area, and in the south-western districts. In the Swartland area, however, the yields were, on the whole, not as good as was expected. Apparently, this wheat is not well suited to sandy soils. Since Renown is a safe variety to plant, it should be grown on a much larger scale in the future.

Klipkous has a beardless ear with white grains. It matures early, grows well and tillers moderately well, but the straw is inclined to be weak. The grains are very firmly attached so that there is no danger of shattering. Its baking qualities promise to be very good. This wheat may be subjected to further baking tests, however, and until such time as these are carried out, it must be classified under Class B. Renown is fairly susceptible to leaf spot (vaalblaar) and moderately susceptible to rust. Seed was made available to farmers for the first time in 1941. Up to the present, reports have been favourable and the variety promises to be a very useful one.

Farrartrou has a beardless ear and white grains. It matures early, tillers and grows well, and has a fairly strong straw but shatters readily and must, therefore, be harvested in the yellow-ripe stage. Farrartrou has good baking qualities and falls under Class A. It is susceptible to leafspot and rust, but since it matures early, it frequently escapes the latter disease. This variety is very similar to Burbank and Florence but, on the whole, produces a higher yield. It is well suited to the drier areas of the Swartland.

In addition to the above, there are also the following varieties which are grown here and there on a small scale: Union 52, Pilgrim, Burbank, Florence, and Beltista. These are all early varieties. Several years ago the first two were very popular, but owing to their susceptibility to rust, they are now being grown to a smaller and smaller extent. Beltista sometimes produces very high yields but these fluctuate widely from year to year. In addition, it is not resistant to the hot, dry winds which are sometimes experienced during the harvesting period.

Another variety which does well at certain places in the south-western districts is Kenia Governor. In the remainder of the winter-rainfall area, however, it gives very poor results and cannot be recommended.

Oat Varieties.

Of the few varieties of oats which can be recommended, the following are the most important:—

Langgewens.—This variety matures moderately early, tillers well, grows vigorously and produces high grain yields. It is eminently suited to the Swartland where it is not easily surpassed by any other variety as regards its yield. Langgewens comes under Class A and is highly valued for malting purposes. It is fairly susceptible to leaf rust and, to a certain extent, also to stem rust. For this reason it is less well suited to the Caledon, Bredasdorp area and to the south-western districts.

Jongensklip is an early selection from Algiers and matures about a week later than Langgewens. It tillers very well and is a vigorous grower. Jongensklip falls under Class A. It is also subject to leaf rust and stem rust but, generally speaking, does better than Langgewens in the Caledon, Bredasdorp area and in the south-western districts.

Algiers matures late, tillers well, and grows fairly vigorously. It falls under Class B. Formerly it was the most important oat variety in the winter-rainfall area, but to-day it has been largely supplanted by Langgewens and Jongensklip.

Boone is an early variety which tillers well and grows fairly vigorously. It falls under Class B. Boone was imported from America a few years ago and for the past two years seed has been made available to farmers. It is highly resistant to leaf rust and less susceptible to stem rust than the above-mentioned varieties.

Highly favourable reports have been received about this variety which appears to be yielding very promising results, especially in the Caledon and Bredasdorp area, and in the south-western districts, where it is apparently playing a very important rôle.

Sunrise is a very early variety which does not tiller very well and the straw is inclined to be weak. It falls under Class B. Sunrise is inferior to the other oat varieties in respect of the grain yield, but as green oats it is very palatable and, consequently, very popular for grazing purposes.

Barley Varieties.

Of the six-row types Cape Six-row, Elses, Cape Early and Beardless Barley-wheat are of importance, while Swanneck is the only two-row barley variety cultivated locally.

Cape Six-row (ougars).—This variety matures late, tillers well, grows vigorously and produces good yields. It is excellent for brewing and is grown for that purpose mainly under irrigation in the Worcester, Robertson, Montagu and Ladismith area. If it comforms to the requirements for brewers' barley, it is classified under Class A. In addition, it is the principal barley variety grown as grain feed under dry-land cultivation.

Elses is an early selection from Cape Six-row and is approximately 7-10 days earlier. It tillers well and grows vigorously. In trials conducted at Elsenburg it out-yielded Cape Six-row. In many areas Elses is gradually ousting Cape Six-row. It is excellent for brewing purposes and as brewers' barley comes under Class B.

Cape Early is an early variety which tillers moderately well and grows strongly. The grain yield is considerably poorer than that of the above-mentioned varieties, but as this variety matures early it is grown principally for green feed.

Barley-wheat is an early variety which tillers and grows well. It is characterized by the fact that the grains separate from the lemmas during threshing—hence the name hull-less or naked barley. In addition, certain varieties do not develop an awn or spikelet but a little hood at the point of the seed. For this reason and also because they are early, such varieties are widely grown as green feed. The grain yield is comparatively poor. Barley-wheat falls under Class D.

Swanneck is an early variety which tillers well, grows vigorously, and produces high yields. As brewers' barley, it falls under Class B. It is recommended that this barley should be cultivated for brewing purposes only along the Olifants River. According to claims made, a barley of better colour and quality is obtained there than in any other area. Owing to the difficulty of separating two-row barley ears from wheat ears, wheat farmers are advised not to sow this variety for feed. If barley is sown for feed, preference should be given to Cape Six-row or Elses. In all cases it would be better to roll the barley before feeding it to stock, the object being to prevent its being carried to wheatlands in the manure.

Classing of Grain at the Threshing Machine.

Threshing is the final stage in the production of grain. After that, the product leaves the farm and that is the last the farmer sees of it. Since all grains are to-day sold on the basis of quality, it is of the utmost importance that, after all the trouble and expense to which the farmer has gone to get his grain into the stack in good condition, he should ensure that his product is threshed in such a way that its quality will not be impaired. One of the prime requisites in this connection is that the threshing machine should be in good

working order; it should not crush the grains which must be properly classed before being discharged into the grain bin.

As soon as the percentage of broken grains in a sample exceeds a certain figure, the grain, and consequently its value, are adversely affected. The grains of certain varieties are more easily broken than those of others. Furthermore, wheat grains are inclined to break more readily when they are fat and also if the drum is allowed to run too fast. To prevent this, it is necessary that the drum should not be driven at an excessive speed. The optimum drum speed is round about 950 revolutions per minute. The breaking of grains can further be prevented by feeding the machine at a uniform rate. It is essential in this connection that the drum speed should also be uniform and for that reason it is important that the power machine should be equipped with a reliable governor or speed regulator.

Sometimes insufficient attention is given to the classing of the grain. Within certain limits, the bushel weight of a sample can be increased or reduced at will simply by setting the screen wider or narrower. It is advisable that the screen should be adjusted to remove as much foreign material as possible, since this merely lowers the grade of the product. Furthermore, it should be set wide enough to separate and remove from the rest all lean and broken grains which also adversely affect the grade. Such material can be used to good advantage on the farm for feeding purposes. If possible, the bushel weight of the grain must be determined at intervals as it comes from the threshing machine. By doing this, it is possible to adjust the screen to the best advantage.

Production of Seed Potatoes:—

[*Continued from page* 142.

(2) *Mosaic virus diseases.*—These occur in various forms. The plants are stunted and the leaves have a crumpled appearance with irregular yellow and light-green spots on the green surface of the leaf; in other forms the spots are greenish-yellow and the leaf has a wrinkled appearance all along the veins. In still another form of mosaic the light-green and yellow-green spots are grouped together in large numbers towards the mid-rib of the leaf, some of the veins of the lower leaves turn black and as the disease spreads along the finer branches of the veining the tissues between the veins die. Later the leaves drop or remain hanging to the stem by thin fibres.

During very hot weather, the symptoms of mosaic are less noticeable, but the wrinkled appearance of the leaves and their tendency to curl slightly downwards are sufficient to identify the disease. If cool weather sets in after a hot spell the symptoms become very conspicuous again.

This so-called virus disease definitely hampers the physiological processes of the plant which cannot function normally, and in severe cases a 20 to 75 per cent. reduction in the crop yield can be expected.

(In writing this article W. D. Davidson's book—"Potato growing for seed purposes" published by the Stationery Office, Dublin, Ireland, was freely consulted.)

Fodder Conservation.

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TO ensure a permanent livestock industry it is of the utmost importance that adequate quantities of fodder of good quality should be available for animals throughout the year. This is particularly true in the case of the more intensive branches of the livestock industry, such as milk production, for example. The precarious climatic conditions and dry seasons which are so characteristic of South Africa make it impossible for the farmer to produce a regular supply of fodder throughout the year. In the winter rainfall area, the summer and early autumn months generally pass without any rain at all, and even with the best will in the world most farmers find it impossible to produce fodder during that time of the year. They are therefore compelled to conserve some of the surplus feed produced in spring for use during this difficult period.

Formerly it was possible to purchase all the necessary concentrates, as well as any other feed that was required. At present, however, the position is altogether different. There is a serious shortage of practically all varieties of feed, the scarcity of protein feeds being particularly acute. Since animal products are the cheapest to produce, if the farmer is self sufficient in regard to his feed requirements, it is essential that more attention should be paid to the production and conservation of fodder.

In the main there are two methods of conserving green feed, viz., by ensiling or by making hay.

A. Silage.

By ensiling is meant the process of conserving green, succulent plants, firmly compacted in air-tight structures. Under such conditions, the plant material undergoes certain changes, the most important being the formation of organic acids which conserve the ensiled material and safeguard it against decomposition.

Requirements for the Making of Silage.—Ensiling is a simple process, and if the following requirements are complied with, good silage can be made from practically any green plant material. The first requirement is the thorough compacting of the material. The presence of air in the mass of fodder is undesirable since this encourages certain undesirable fermentation processes, which may result in rotting of the material and render the ensiled product useless. The more compact the material in the silo is, the better will be the quality of the silage. For this reason, and also because animals consume finely cut feed more readily and therefore waste less, it is advisable to cut the material into lengths of approximately 1 inch.

In the second place the success of the ensiling process is closely bound up with the quantity of sugar present in the green plants. A certain minimum percentage of sugar is necessary for the formation of the absolutely essential lactic acid. Adequate quantities of lactic acid are of the utmost importance, since this substance safeguards the ensiled material against decomposition, and suppresses the development of undesirable fermentation processes. If the amount of sugar in the material is inadequate, sufficient lactic acid cannot be formed with the result that decomposition of the silage will set in. The deficiency of sugar in plants with an inadequate sugar-content must therefore be supplemented.

In the third place, the moisture content is of importance. If the plant material has an excessive moisture content, its conversion into good silage will be more difficult, since the surplus moisture is squeezed out as the silage begins to settle. Many silos are not watertight, so that the moisture drains off and valuable nutrients are lost. A high moisture content is also conducive to the formation of excessive acetic acid. Acetic acid is always present in silage, but an excessive percentage is undesirable since it imparts a sour taste to the silage and makes it less palatable. Nor is it desirable, on the other hand, to ensile plant material which is too dry, since difficulty will be experienced in thoroughly compacting such material which is then inclined to become mouldy. A moisture content of approximately 75 per cent. is ideal for ensiling purposes. *Green plants cut and ensiled at the correct stage will have a moisture content very nearly approaching the optimum percentage.* Should the moisture content be too high or too low, however, the material may either be allowed to wilt, or water may be added.

Silage Crops.

Green plants can be divided into three groups according to the ease with which they can be ensiled, viz., grass crops, legumes, and brassicaceous plants, i.e., plants of the cabbage family.

Grass Crops.—Many of the ordinary plants, such as maize, kaffircorn, wheat, rye, barley and oats fall in this group. Of these, maize is the ideal silage crop, but any of the above plants can be successfully ensiled without much difficulty. The best time at which to cut a crop for silage purposes ranges from the early dough to the doughy stage, when the sugar content is high and the plants also have the optimum moisture-content. Unless these crops are ensiled while still very young, the addition of sugar will be quite unnecessary.

In the winter-rainfall area oats and barley can be cultivated in any quantity for silage purposes. The yield of green material will vary considerably; on stubble-lands from 6 to 8 tons per morgen may be expected, and on fallow-lands from 10 to 15 tons. The best time for cutting is in the early doughy stage, just before the ears and tips show signs of turning colour. From a nutritional point of view, these plants have one shortcoming, namely that, although they contain an abundance of carbo-hydrates (sugar and starch), they are deficient in proteins. For animals in production a much better balanced feed can be obtained by ensiling this crop together with some or other protein-rich crop.

Legumes.—Legumes such, as lucerne, vetches, cowpeas, etc., are exceptionally rich in proteins and as such are extremely valuable fodder plants. On the whole, they contain a comparatively small percentage of sugar, and this deficiency of sugar must be supplemented to ensure the production of good silage. Molasses is the cheapest source of sugar and its use is therefore recommended.

Forty to sixty lb. of molasses dissolved in 10 gallons of water is poured over each ton of material ensiled with a watering can, and then mixed in. If a chaff cutter equipped with a blower is available, the sugar solution can be mixed very thoroughly with the green fodder by preparing the solution in a drum and allowing it to run slowly from the drum through a tube into the blower. If molasses is not available, the sugar deficiency can be supplemented by ensiling equal quantities of the legume crop and some other crop which is rich in sugar, such as maize or oats. The two crops are then passed through the chaff cutter simultaneously.

One of the weakest links in the farming systems of the winter-rainfall area is the fact that relatively few protein-rich legumes are cultivated there. The main reason for this is that the choice of suitable plants for that area is very limited. Vetches are the only annual legumes which can be grown as a silage crop with a reasonable measure of success. This crop grows best on low-lying, sandy soils which are fairly moist during the spring months. The best method of cultivation is to sow it mixed with some or other cereals, such as oats, at the rate of 20 to 30 lb. vetches to 100 lb. oats per morgen.

Many farms in the winter-rainfall area are infested with wild vetches or so-called "wild peas", the nutritive value of which is practically on a par with that of lucerne. Farmers could, therefore,

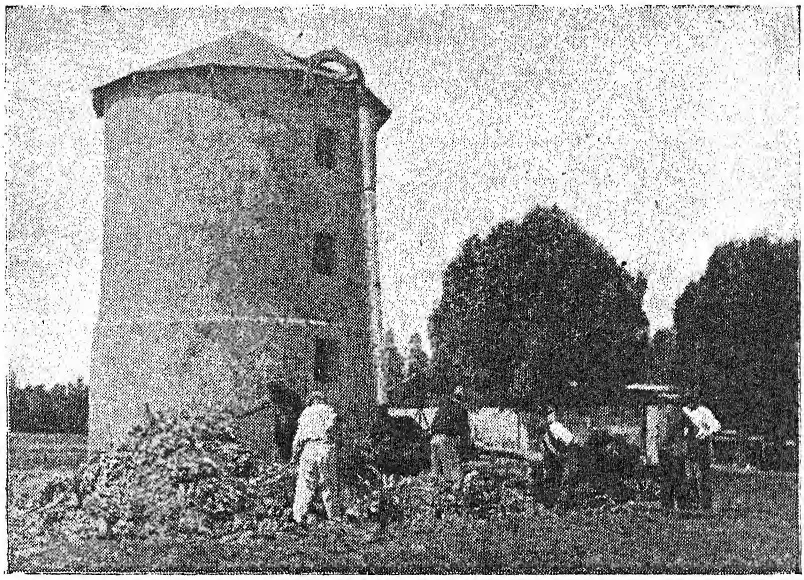

FIG. I.—Kale being ensiled.

do nothing more sensible than to cut the infested portions of their grain lands and ensile the material thus obtained; in this way a troublesome weed can be prevented from running to seed and the material converted into an asset.

Should the vetch-grain mixture contain not more than 60 per cent. vetches, it will be unnecessary to add sugar, but should the percentage of vetches be higher, 1 to 3 per cent. molasses must be added. The greater the percentage of vetches, the larger must be the quantity of molasses which is added. The best stage at which to ensile vetches is as soon as the pods are well developed. If vetches are sown together with oats, the normal time for cutting would be as soon as the tips of the panicles begin to show signs of turning colour.

Of the legumes, lucerne is the one which is best adapted to the winter-rainfall area, and yields excellent silage provided the deficiency of sugar is supplemented. If lucerne is ensiled alone, from 2 to 3 per cent. molasses should be added. The higher percentage of molasses is added if the lucerne is young. As in the case of vetches, the addition of molasses is unnecessary when equal quantities of lucerne and a crop rich in sugar are ensiled. The best stage at

which to cut lucerne for silage is when 10 to 30 per cent. of the plants are in flower. If the lucerne flowers poorly, as is often the case in early spring, the crop should be cut as soon as the eyes in the crown of the plant begin to bud.

Brassicaceous Plants.—Plants of the cabbage family are pre-eminently suited to cultivation for green feed, but any available surplus can be very successfully utilized for silage purposes. A characteristic of these plants is that they are comparatively rich in both sugars and proteins, and when grown for green feed, their composition is ideal for milk production. Cabbage plants have a comparatively high water content, and when ensiled without being mixed with some other crop, a considerable percentage of the moisture drains off. Better results are obtained when they are mixed with plants containing less water. Both rape and kale yield excellent results when ensiled together with oats or barley. An excellent silage mixture is obtained if oats and rape mixed at the rate of approximately 100 lb. and 5 to 8 lb., respectively, per morgen, are sown in autumn. The addition of sugar is unnecessary if brassicaceous crops are ensiled alone or together with a cereal crop.

Advantages of Silage.

By utilizing cereal crops for the making of silage, a larger yield of digestible nutrients per unit of area is obtained than is the case when such crops are allowed to ripen. It has been calculated, for instance, that oats ensiled in the early doughy stage will yield 20 per cent. more energy value and approximately 75 per cent. more protein value than mature dry oats. This calculation is based on the assumption that all the chaff obtained by threshing is fully utilized by the animal together with the grain. In practice, however, this is never the case, and the advantage derived from feeding silage will in all probability be even greater than stated. The difference in favour of silage is due to the fact that for silage purposes oats are cut in a much less advanced stage of development and possess a much higher degree of digestibility.

In addition, silage is one of the most inexpensive forms of feed, as the following example will prove. At the Langgewens Experiment Station the grain yield of oats sown on fallowed land is approximately 20 bags per morgen. If such a crop of oats is ensiled, the yield obtained amounts to approximately 12½ tons of silage per morgen. The energy value of the silage is equivalent to that of 20 bags of maize, whereas its protein value is equal to that of 40 bags of maize. At the above experiment station the production costs of oat silage are calculated at 12s. 6d. per ton. In other words, the cost of producing 12½ tons of silage is £7. 16s. 3d., whereas 20 bags of maize at the current price of approximately 17s. 6d. per bag will cost the farmer £17. 10s. Apart from the fact that the silage has a much higher protein value, the cost of the maize to the farmer is more than double that of the silage.

In addition to the above-mentioned advantages, well made silage can be kept for an indefinite period. The farmer who makes silage can, therefore, have a supply of succulent feed for his animals at any time of the year. The space required for the storage of silage is comparatively small; approximately 36 to 40 lb. of silage occupy 1 cubic foot. Silage is fireproof and there is consequently no risk of fire. In conclusion, well-made silage is not only wholesome and palatable, but also promotes the appetite and good health of the animal.

Filling the Silo.

It has already been pointed out that thorough compacting of the fodder mass is essential; this is best secured by having the fodder well trodden down throughout the ensiling process. Another point to be borne in mind is that the fodder in the centre of the silo must always be higher than along the sides. If the mass is not trodden down well and uniformly, the fodder along the sides will shrink away as soon as the contents of the silo begin to settle, with the result that the silage will rot or become mouldy all along the sides.

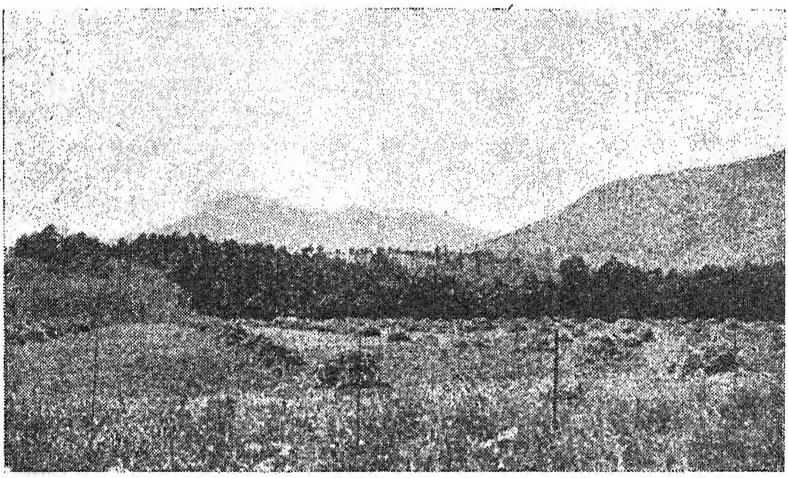

FIG. 2.—A good yield of lucerne hay produced under dry-land conditions.

Should the filling of the silo be interrupted for more than 24 hours, it would be advisable to cover the silage with old sheets of galvanized iron or something similar weighted down. When the ensiling process is resumed, any rotten or mouldy silage must be removed before the filling of the silo is continued. When filled to capacity, the silo can be sealed in various ways. A layer of wet chaff, approximately 6 inches thick, can be spread over the silage and thoroughly trodden down; old sheets of galvanized iron are placed over this and held down by weights. If the silage is made in a pit silo, it can be sealed with a layer of soil 4 to 6 inches thick. In the case of a tower silo, however, the use of soil is impractical.

After the silo has been filled, the silage usually subsides considerably. If the farmer wishes to make the fullest use of the silo space, sealing should be postponed until the silage has settled, when the upper layer of rotten material must be removed. The silo is then filled again and sealed.

Well-made silage keeps for an indefinite period, but rotting soon sets in on its being exposed to air. Therefore, when a silo is opened, a layer of at least 2 inches must be removed every day. Should this not be done, the upper layer will rot after a few days and automatically seal the remaining contents.

Types of Silos.

In South Africa there are three main types of silos in use, viz., the tower silo, the pit silo and the trench silo. The tower silo, which is the most expensive type to erect, is built of reinforced concrete or

bricks. In the long run it will probably be found the most inexpensive, since it is a permanent structure. In addition, the loss of silage is also smaller than in the case of the other types.

The attention of farmers is drawn to the fact that Government aid can be obtained for the construction of silos; this enables the farmer to build a silo comparatively cheaply. Those desirous of taking advantage of these facilities, should apply before commencing building operations. Application forms and particulars are obtainable from magistrates, extension officers, colleges of agriculture and from the Division of Soil and Veld Conservation, P.O. Box 965, Pretoria.

B. Hay-making.

The making of hay is probably the oldest and most common method of conserving fodder. The process amounts to this: green plant material—usually containing between 70 and 85 per cent. water—is dried until the water content has been reduced to approximately 20 per cent. or lower, when it can be safely stored.

In the winter-rainfall area, most farmers make only lucerne hay and oat hay. The lucerne hay is made almost exclusively in the irrigation areas, especially along the Olifants River, and in the area extending from Worcester to Ladismith. The greater part of the oat hay is produced in the Swartland.

Lucerne Hay.

Lucerne hay is the most valuable hay that can be produced. If it is of good quality, it is very palatable and has a high nutritive value.

The production of lucerne hay of good quality is an art which can be acquired only through experience. The following are the requirements for good hay: the hay must have a good green colour; it must be leafy; it must not be mouldy; the stems must be fine, and it must be free from weeds.

The colour of the hay is determined largely by the method of drying and the climatic conditions prevailing at the time of drying. The longer the period during which the cut lucerne is exposed to the direct rays of the sun, the greater will be the amount of bleaching and the poorer the colour of the hay. Certain vitamins will also be destroyed. Bleaching can be reduced to a minimum by raking the hay into windrows and heaps with as little delay as possible. This allows only a small portion of the hay to be exposed to the direct rays of the sun. If it should rain while the hay is being dried, a large proportion of the valuable nutrients will be leached out. This loss is quite considerable if rain occurs when the hay is almost dry; nutrients are washed out more readily then than just after the material has been cut. In this respect several showers will cause much more damage than one heavy downpour. The colour of the hay is also an indication of the intensity of the fermentation processes which take place after the hay has been stacked or baled. If the hay contains too much moisture when it is stacked or baled, excessive fermentation will occur accompanied by the generation of heat and a change of colour ranging from light brown to very dark brown. This change is also accompanied by a considerable decrease in the nutritive value of the hay. The proteins in particular are rendered indigestible. The darker the colour of the hay, the greater is the loss of nutritive value, and consequently, the lower the value of the hay. Such hay is also inclined to become mouldy, which is undesirable at all times, since the moulds not only partially destroy the nutrients and vitamins, but may even poison stock.

The nutritive value of hay is closely related to its leafiness. Calculated per unit of weight, the percentage of digestible nutrients contained in the leaves is twice that in the stems. The aim should, therefore, be to reduce the loss of leaves to a minimum during the drying process. The leafiness of hay depends primarily upon the method of drying. Normally, water evaporates much more rapidly from the leaves than from the stems. If the lucerne is cut and left exposed to dry, the leaves will dry out long before the stems and become brittle, with the result that they break off as soon as the hay is handled. To prevent this, drying of the leaves and stems should take place more uniformly; this is achieved by raking the lucerne

FIG. 3.—Hay being loaded.

into windrows before it is dry—usually as soon as it has become wilted—and then into wind heaps.

The stage at which the lucerne is cut also affects the leafiness of the hay. Usually lucerne is cut from the bud stage (before flowering) to the full flowering stage. The leafiest hay is obtained when the lucerne is cut in the bud stage. It has been found, however, that after constant cutting at such a young stage the plants deteriorate and that the stand becomes thinner, with the result that the yield is poorer. If the lucerne is allowed to develop into the full flowering stage, the stems become woody and many of the leaves fall off, especially the lower ones. Consequently, the hay produced will be of inferior quality. The best results are obtained if the lucerne is cut in the 10 to 30 per cent. flowering stage; not only does this ensure the production of the largest percentage of digestible nutrients per morgen, but the life of the plant will also not be adversely affected.

Hay with fine stems is less woody, contains less fibre, and is more digestible than coarse hay. The fineness of the hay is determined by the density of the stand. Thorough preparation of the soil and the use of reliable seed are therefore essential to ensure a dense stand. To prevent the inclusion of a large percentage of weeds in lucerne hay, the field should be cleared of weeds as far as possible before sowing the lucerne, and only good seed, free from weeds, should be used.

The hay-making process.—Lucerne hay cannot always be made according to certain fixed instructions; the procedure to be followed is subject to constant modification depending upon the prevailing climatic conditions. On the whole, summer rains are not a common occurrence in those parts of the winter-rainfall area where lucerne hay is made, so that the hay can be dried within a comparatively short time. The procedure to be followed is more or less as follows:— The lucerne is cut with a mowing machine in the morning, as soon as the dew has evaporated off the plants, and is then left lying on the field until quite wilted—this usually takes from several hours to a full day. The lucerne is then raked into windrows and left for about one day; wind heaps are then made and left until the lucerne is dry enough to be stacked or baled. The lucerne should never be raked together and made into heaps during the hottest part of the day, since this would cause too great a loss of leaves. The farmer should try to dry his hay during dry weather as far as possible. If rain threatens, it would be advisable to postpone cutting for a day or two. Apart from the fact that a considerable proportion of the nutrients is leached out if the hay is drenched by rain on the field, such hay must be turned at frequent intervals, thereby increasing the cost of the hay-making process. Furthermore, the less hay is handled, the smaller is the loss of leaves.

Stacking.—As soon as the hay is dry enough to be stored with safety it should be stacked. With a little experience the farmer will soon learn when this can be done. Certain tests may also serve as a guide. If, for instance, a few stems of the hay are taken and twisted without any juice being squeezed out, or, if a handful of hay does not feel cold when held against one's cheek, it may be assumed that the hay is sufficiently dry for stacking.

Hay should be stacked on a dry spot; if possible, a layer of stones or straw may be laid down as a foundation, and if the hay is stacked on the same place every year, an inexpensive, permanent foundation of stone and cement could be constructed. The stacks may be round or oblong; the shape is not of much importance, however, but it is essential that the rick should be thoroughly stacked. In view of the compacting of the stack, it is desirable to have the hay as firmly stacked as possible in the centre, and loosser towards the sides. This will prevent hollows from forming in the stack through which water could easily penetrate. In addition, the top should have a sharp slope to allow water to run off readily after the hay has settled.

Baling of the Hay.—The hay can be baled straight from the wind heaps or first be stacked and baled later on. In the former case there is less handling of the hay, thus ensuring lower costs. It should be borne in mind, however, that hay baled direct from the wind heaps must be drier than hay which is stacked. Since baled hay is very firmly compressed, there is practically no circulation of air in the bale, with the result that the evaporation of moisture from baled hay is a difficult and slow process. The hay might therefore easily

become mouldy if baled with a slightly excessive moisture content. If the moisture content is somewhat high, the baled hay might even generate heat and turn a dark colour. All things considered, it is safer to stack hay before baling it. In order to limit leaf wastage as far as possible it is advisable to bale only during the cooler part of the day.

Oat Hay.

The annual production of oat hay in the Union ranges from approximately 75,000 to 100,000 tons, roughly 60 per cent. of this crop being grown in the Cape Province. The greater part of this hay is produced in Swartland.

The quality of the oat hay still leaves much to be desired. The reason for this is that the oats are allowed to reach the doughy stage before being cut, with the result that the crop is too far advanced for the production of first class hay. In fact, oats intended for hay are generally cut at almost the same stage of maturity as oats produced for grain. So, for example, it has often happened that when the price of hay was unremunerative, the oat crop was simply threshed and the grain used or sold as such. To a certain extent, the reason for this state of affairs must be ascribed to the fact that there is no discrimination as regards prices in accordance with the quality of the hay. If oats are cut at the correct stage for hay-making, the yield will necessarily be somewhat lower than when the crop is cut at a more advanced stage. If oats are cut at a younger stage, however, the hay will not only be much more digestible, but also have a higher nutritive value, as well as a greater value per unit of weight. It will therefore pay a farmer who uses his own hay for feeding purposes to produce the better quality, but if he produces for the market, he will find this unprofitable unless he obtains a relatively higher price.

In order to produce first class hay, the oats should be cut in the milk stage, or at the latest, in the early doughy stage, in other words, as soon as the panicles show the first signs of turning colour. An ordinary self-binder is used for cutting oats. As soon as the crop has been cut, stooks should be made consisting of from 10 to 12 sheaves placed upright against each other. After approximately 8 to 10 days the hay will be dry and can then be properly stacked in ricks or cocks. For the production of hay with a good colour, it is of the utmost importance that this procedure should be followed. If the sheaves are left lying on the field to dry, the hay will bleach and its colour will consequently be poor.

The nutritive value of oat hay can be increased by sowing the crop together with vetches, as described above under silage. In this case too, the crop is harvested with a self binder as soon as the oats reach the milk or early doughy stage. Excellent hay can also be made from oats infested with wild vetches. The same procedure as described above is followed. If only wild vetches are growing on the land, hay can be made from the weed in the same way as in the case of lucerne.

From the nutritional point of view, hay consisting of a mixture of oats and vetches is of greater value than pure oat hay, the protein value, especially being higher. Nevertheless, a certain amount of prejudice against such hay is sometimes encountered, so that the prices realized for it are often lower than those obtained for hay made exclusively from oats.

Rape.

Dr. P. W. Vorster, Department of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

LIKE other members of the cabbage family, rape is a cool-season or winter crop. It is not able to resist extreme cold, but makes very rapid growth in the winter-rainfall area during the winter months. In addition, it is fairly hardy and drought-resistant. Although it can also be grown in the summer, it is very susceptible during warm weather to damage by insect pests, especially the cabbage moth, which sometimes causes great destruction.

Rape produces large quantities of succulent leaves with a high nutritive value. It is a very valuable pasture crop, especially for sheep. In fat-lamb production, rape provides one of the best forms of grazing, not only for the lambing ewes, but also for fattening the lambs themselves. The fact that rape is so well-balanced makes it pre-eminently suitable for finishing off the lambs for the market. It may also be used for dairy cows provided the animals are put to graze on it just after having been milked to ensure that the milk will not acquire a cabbage taint or smell.

Time for Sowing.

Rape should be sown from April to May in order to be suitable for grazing from July onwards. Farmers sometimes sow rape on their fallow lands during August for early summer grazing, but this entails a considerable risk of severe damage to the plants by the cabbage moth. In addition, rape plants withdraw large quantities of moisture and plant nutrients from the soil, as a result of which the land will require much heavier applications of fertilizer during the following year.

Rape can be sown alone, as a pasture crop, but is generally grown together with some other cereal, such as barley or oats. A mixture of rape and oats or barley yields excellent material for silage.

Rape should preferably be sown in several small fields or camps where the soil can be thoroughly prepared and fertilized, and not on large lands which cannot be properly cultivated and fertilized. Where possible, at least 10 tons of stable manure or compost per morgen should be ploughed in, with the addition of 600 lb. of mixture F. per morgen at sowing-time. If no stable manure or compost is available, 800-1,000 lb. of mixture F. per morgen should be applied. Since rape is cultivated for its leaves, it reacts very well to applications of nitrogenous fertilizer.

If rape is cultivated alone, it may be sown at a rate of 10 lb. per morgen, but when the crop is to consist of rape together with oats or barley, a mixture of 5 lb. rape and 100 lb. oats or barley per morgen is required. Rape seed can be broadcast and then, using a harrow, covered with a light layer of soil. For sowing the rape-and-oats or rape-and-barley mixture, a drill may be used. The rape variety cultivated in South Africa is the Dwarf Essex.

When sown in April and May, rape can be grazed from July onwards, and if grazed judiciously, will provide large quantities of valuable grazing until late in spring. Even when cut as a silage crop, the amount of after-growth will be sufficient to provide an excellent finishing grazing for fat-lambs before marketing.

On account of the risk of bloating, precautions should be taken when animals are put to graze on rape for the first time. Sheep must

 [Continued on page 168.

Better Feeding.

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AN animal which has eaten its fill, is not necessarily well nourished. This is particularly true of rapidly-growing and high-producing animals.

We have taken the animal under our protection, whe have transformed and upset its mode of life to conform to our economic requirements. It is therefore our duty to provide for the increased needs of the animal which have been artificially created for it. Do our animals always receive sufficient feed even for maintenance?

And what is the position in regard to growing animals? Do they always grow out well or are they stunted in their growth? Have they any resistance to disease? Do they always develop a normal conformation or do they sometimes remain undersized, lack depth of body, and have a weak rump, narrow breast or weak stance? Are these features not perhaps indications of defective feeding?

Basic Principles of Feeding.

Every area has its own nutritional problems, which generally vary according to climate, lines of production, marketing facilities, etc. The basic principles of feeding, however, remain the same everywhere. The only differences lie in problems created by the practical application of the principles of feeding in the various areas. From the economic point of view, one of these principles is the endeavour to be self-sufficient in regard to stock feeds in so far as this is practically and economically possible. A second principle to bear in mind is that the less feed is handled, the cheaper will it be when ultimately fed to animals. In the first place, therefore, it will be necessary to produce as much feed as possible in the form of grazing, silage, hay, root crops, cereals, seeds, etc., on the farm itself, and secondly, to rely as much as possible in favourable seasons on pastures which do not require any handling. Apart from the economic aspects, animals are much healthier and more fertile when they have a regular supply of good grazing. There is, however, yet a third basic principle, viz., the necessity for producing feeds during favourable seasons and conserving these for times of scarcity. The object of this is to be as independent as possible of purchased feeds, to keep production as uniform as possible and to safeguard young, growing animals against setbacks. Feeds may, of course, be conserved in the form of silage, hay, cereals or seed, but of these, silage appears to be the most economical. (See article on silage elsewhere in this issue).

In so far as nutrition or the utilization of nutrients by the animal, is concerned, there are also a few outstanding principles which should constantly be borne in mind.

Importance of Protein.

The important basic principle here is that milk-producing or young, rapidly growing animals require a large percentage of proteins in their feed, and it may be added in this connection that the greater the number of feeds used to supply this protein, the better the results. The higher the milk production or the younger the growing animal, the greater are its relative protein requirements. In fact, the growth of the animal is closely corrrelated with the protein intake. That is why nature has provided such liberal quantities of protein in mother's milk, as is evidenced by the fact

that dried cow's milk contains more than 25 per cent. protein. If we bear in mind that the feed of an animal should contain at least one and a half to twice the quantity of protein secreted in her milk, we will realize that a very liberal supply of protein is necessary in the rations of milk producing animals. A deficiency of protein in the dairy cow's ration will ultimately reduce the milk-flow and even adversely affect the fat secretion.

There are, however, also several other aspects of nutrition which should be borne in mind, viz., the mineral and vitamin requirements of growing, producing and breeding animals, while the fat content of the rations of dairy-cows can not be entirely overlooked.

The most important minerals of which there is frequently a deficiency are calcium, which can be supplemented in the form of agricultural lime, limewater, bonemeal, etc., and phosphorus which is usually provided in the form of bonemeal.

As regards the vitamins, there is a large number of them, and the absence of any one is capable of producing a whole series of alarming symptoms. With proper attention, however, there is usually little danger in practice of any serious deficiency occurring. Sometimes, however, a deficiency of vitamin A and D may cause trouble. A deficiency of the former may, among other things, result in poor growth, reduced fertility or paralysis, as is sometimes the case with pigs. A vitamin A deficiency may occur in animals kept solely on veld during the dry seasons of the year, calves which receive skimmed milk but no green feed or good hay, or in pigs which are kept in sties and fed on skimmed milk without being given good legume hay, green feed or yellow mealies. Vitamin D, is associated, amongst other things, with bone-formation and a deficiency may occur when young animals do not get sufficient direct sunlight and do not receive good hay. A vitamin A deficiency can be most satisfactorily supplemented by green feed, green grazing, silage and good legume hay, such as lucerne hay, and a vitamin D deficiency, by sunlight or good legume hay. This is one of the reasons why green feed, silage and good legume hay, or even lucerne meal are recommended, particularly for producing, growing and breeding animals. An exceptionally interesting fact recently demonstrated in Australia is that there is a marked decrease in the fertility of rams as a result of a vitamin A deficiency about six months after the veld becomes dry. This fact suggests the possibility that many of our animals when kept solely on veld may also suffer from a deficiency of vitamin A towards the end of our dry seasons.

It appears that the fat content of the ration may affect the milk production of animals. A ration with a low fat content is apparently not conducive to high production Some authorities are of the opinion that the production ration should contain at least 70 per cent. of the quantity of fat secreted in the milk.

Protein the Most Serious Problem.

Except in the areas under irrigation where lucerne is cultivated on a large scale, the most serious problem in the winter-rainfall area is the production of adequate protein-rich feeds to satisfy the needs of the ever-expanding dairy, fat-lamb and pig industries. Particularly in view of the present scarcity of protein, strenuous efforts will have to be directed at cultivating as many protein crops as possible.

From the nutritional point of view, lucerne is the most important protein-rich crop which can be successfully cultivated in this area. It can be fed in the form of winter grazing, silage or hay to meet the

nutritional requirements of animals. *The greatest discretion will have to be exercised, however, when feeding lucerne.* Dairy cows and young, growing animals should be given preference on the available lucerne grazing and, in order to balance the feed with crops which are rich in starch, the lucerne should be grazed alternately with oldland grazing or cereal or barley pasturage. Not only does lucerne meet the protein requirements of the animal, but its high lime content also provides a mineral which is often lacking in rations. In addition, the hay, when well made, may be regarded as one of the main sources of several important vitamins. It is for these reasons that green lucerne, lucerne silage, lucerne hay and even lucerne meal play or ought to play such an important part in the rations of dairy-cows and all young, growing and pregnant animals. The cow which recently scored the record for milk production in America was literally covered with lucerne hay every day. In the Western Cape Province several other protein-rich crops are also cultivated which can contribute towards supplementing the protein requirements, e.g., vetches, peas, wild vetches and, in certain areas, subterranean clover. The protein content of all these crops is very much on a par with that of lucerne. Good hay and silage, can be made from the first three crops, but they are not very suitable for grazing; the last-mentioned, however, is an excellent pasture crop. Another group to be taken into consideration is the cabbage group such as kale, rape, cabbage and cauliflower, the leaves of which are rich in protein and an excellent feed for milk production. Practically all the other crops which can easily be cultivated here on a larger or smaller scale, are either low in protein or rich in starch. So, for example, all our cereals and their hay or straw, green cereal crops and grasses (except when very young), green maize plants, sudan grass, millets and the silage made from them, mangolds, kaffir watermelons, cattle pumpkins, sweet potatoes, fruit, acorns, etc., are low in protein but rich in starch or sugar.

The Choice of Concentrates.

It is not always possible under all circumstances, to meet the feed requirements of our animals with locally produced feeds and sometimes it becomes necessary to purchase supplementary feeds. Of the roughages, lucerne hay is undoubtedly the most popular, and rightly so. In view of the less favourable conditions in the Western Cape Province for the cultivation of protein-rich crops, it is virtually essential for lucerne hay to be purchased if dairy-farming is practised to any extent.

Of the concentrates which are rich in starch, mealie meal has always been the basic feed. Where the price allows, it should be partially replaced by winter cereals. Other concentrates which may be substituted for part of the maize are hominy chop, acorns, dried pear meal, etc. Pound for pound practically none of these feeds is quite the equivalent of mealie meal. Among the protein-rich concentrates, wheaten bran and groundnut oil cake are probably the best-known. It should be borne in mind, however, that the protein content of the different oil cakes placed on the market is not the same in all cases. The protein content of linseed oil cake is approximately 80 per cent., that of maize germ and coconut oil cake approximately 50 per cent. and that of palm kernel oil cake only about 40 per cent. of the protein content of groundnut oil cake. First on the list of our better known oil cakes is therefore groundnut oil cake with a protein content of at least 45 per cent., whereas palm kernel oil cake comes last with a protein content of at least 14 per cent. It

should be borne in mind that acorns and the oil cakes made from groundnuts, maize germs and linseed, are inclined to produce a soft fat (butter and lard), while the cakes from coconut and palm kernel, on the other hand, produce a firmer fat. The protein requirements may be supplemented not only with oil cakes but also with other feeds containing vegetable proteins, e.g., wheaten bran, brewer's grains, maize, gluten, peas, beans, etc. In addition, animal by-products make a valuable contribution towards the protein requirements of animals, particularly of pigs and poultry. In fact it is desirable that at least a part of the protein requirement of the above-mentioned animals should be fed in the form of an animal product. The choice here lies between blood meal with a protein content of at least 70 per cent., meat meal with at least 65 per cent., white fish meal with at least 64 per cent., ordinary fish meal with at least 52 per cent., carcass meal with at least 45 per cent., protein, and crayfish meal with at least 42 per cent., protein. Amongst the meals mentioned, properly prepared white fish meal ranks high as a protein feed. Fish meal and carcass meal provide, in addition to protein, the minerals, calcium and phosphorus, which is an important consideration in view of the present scarcity of bonemeal. Crayfish meal is particularly rich in calcium and also contains a fair percentage of iodine. If a legume hay, fish meal and carcass meal are absent in the ration, it will be necessary to supplement the concentrate mixture with the minerals calcium and phosphorus, while a small quantity of salt must in any case be added.

Balance the Nutrients.

If the greatest benefit is to be derived from the concentrates, it is very important that the correct percentage of protein should be incorporated in the ration. This percentage depends, of course, upon whether the dairy cows and young, growing animals graze on protein-rich pastures or receive abundant protein-rich hay or protein-rich silage. Good dairy cows which depend upon grazing, hay or silage which is poor in protein should be fed a concentrate mixture containing 17-20 per cent., protein, according to circumstances. As the protein-rich grazing, hay or silage is increased, the protein in the concentrate mixture may be reduced. Dairy-cows and young, growing animals kept on protein-rich pastures, such as lucerne, clover, or something similar need merely be given an additional cereal mixture rich in starch. In this way a considerable saving may be effected in the protein-rich pasture, particularly when the supply is limited. When protein-rich feeds are plentiful and inexpensive, they should not be used too sparingly when preparing feed mixtures.

Calves may at first be fed on a concentrate mixture with a protein content of approximately 18 per cent., which may gradually be reduced as they become older and graze on protein-rich pastures or receive other protein-rich feeds.

Baconers may be fed a mixture containing 18 per cent., protein at the weaning stage, the amount being gradually reduced to approximately 13 per cent., as they grow older. Even this protein percentage may be reduced if the young pigs receive protein-rich grazing or skimmed milk.

Substitute Values of Feeds.

In these times of feed scarcity it is frequently asked what the exchange or substitute value of certain locally produced feeds or waste products is. In view of the fact that comparisons, are liable

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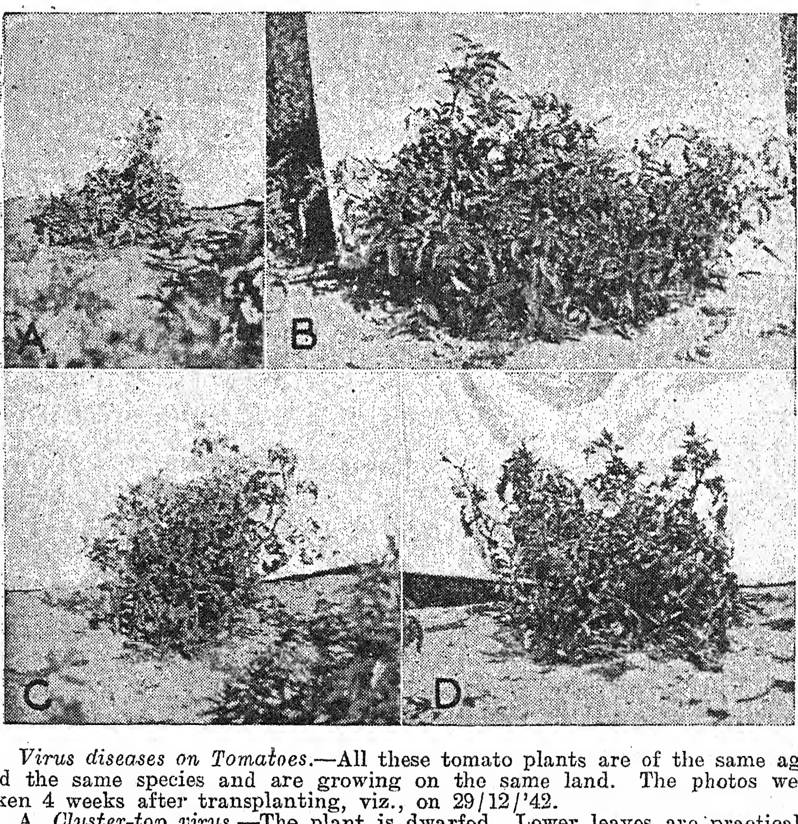
The Control of Virus Diseases in Tomatoes.

Dr. B. J. Dippenaar, Stellenbosch-Elsenburg College of Agriculture.

THE chief diseases with which tomato-growers in this area have to contend are the virus diseases. This group of diseases is usually known among growers as " krimpsiekte ". Affected plants are first retarded in their growth and then become progressively smaller in comparison with healthy plants. Sometimes only the tips die back, but generally speaking the plants die off completely at a comparatively late stage of growth.

Types of Virus Diseases.

The tomato plant is subject to numerous different types of virus disease. Figure 1 illustrates three different types which were



Virus diseases on Tomatoes.—All these tomato plants are of the same age, and the same species and are growing on the same land. The photos were taken 4 weeks after transplanting, viz., on 29/12/'42.

A. *Cluster-top virus.*—The plant is dwarfed. Lower leaves are practically normal, but leaves higher up are smaller and clustered together owing to the exceptionally short internodes. On the right there is new growth with longer internodes above the cluster.

B. A healthy plant. The lower leaves are not curled in and those at the growing tip are comparatively large and vigorous.

C. A plant infected with *Mosaic.* Its size is below normal and the leaves are misshapen and curly. Light green and darker green areas are visible on the leaves.

D. *Spotted Wilt* or " kromneksiekte " of tobacco in tomatoes. The plant is slightly dwarfed and its leaves are curled in. Some of the growing tips have died off and on some leaves appear small, round, concentric brown spots. The green fruits already show slightly raised, concentric, light green spots.

encountered on one and the same land in December of last year. One common characteristic of all these virus diseases is that they are infectious, although the ways in which healthy plants become infected, may differ, according to the type of virus disease affecting the plant.

The three main virus diseases which occur in tomatoes in this area are (1) the so-called "spotted wilt" which is the same as the kromnek disease in Turkish tobacco; (2) a mosaic virus disease, and (3) a type which causes dying back of the tips of shoots and the formation of brown streaks on the stems.

There is not much danger of transmitting virus diseases in tomatoes from one season to another in the seed, especially not in seed a year old; neither is it likely that the diseases will be able to persist for a long time in the soil in which infested plants have grown. The possibility of this happening in the case of some virus diseases of tomatoes is, however, not excluded, and this should be taken into account in considering precautionary measures against these diseases.

Mosaic disease is easily transmitted to healthy plants merely by touching a healthy plant after having rubbed an infected plant with the fingers. The other types of virus diseases, however, can be spread under natural conditions only by specific kinds of insects such as thrips and plant lice in the case of each virus.

Control Measures.

Having regard to all these facts, the following measures were evolved and applied fairly successfully in the experiments conducted at this institution. It should be remembered, however, that since no infected plant can be cured by spraying or any other means, the methods and measures applied should be timely as well as thorough.

(1) Seed beds should be made on fresh soil at a distance from the flower or vegetable garden and also remote from potato or tobacco lands, since those plants may harbour the virus diseases and the insects which spread them.

(2) The surrounding grass, weeds, or bushes should be thoroughly dusted with fine sulphur in order either to destroy the thrips occurring there or keep them away from the seed-beds.

(3) As soon as the tomato plants have obtained a height of about one inch, they should be thoroughly dusted with nicotine or sulphur dust. Care should be taken not to introduce too much sulphur into the soil, since this may make the soil sour and impede the growth of the young seedling, particularly in sandy soil.

(4) Thereafter the seedlings must be given a weekly dusting with nicotine and sulphur alternately until transplanting time. (The nicotine kills both thrips and plant lice, but sulphur is only effective against thrips.)

(5) Just before transplanting, the seed beds may be heavily dusted with sulphur, so that it will not be necessary to dust soon after transplanting.

(6) Transplant at a rate of 30 to 50 per cent. more plants to the row than finally required, the object being to compensate for any diseased plants which may have to be pulled up.

(7) About three weeks after transplanting, the plants must again be dusted with sulphur, the application being repeated two to three weeks later.

(8) Examine the plants on the lands while they are growing, i.e., about three weeks after transplanting and subsequently every ten

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Economic Feeding of Dairy Cattle.

L. C. Zeeman, Animal Husbandry Officer, Cape Town.

IN the present circumstances it is absolutely essential that the best use should be made of available feeds, especially in the winter-rainfall area, where comparatively inexpensive, natural grazing is exceedingly limited. In the common interest, therefore, every possible effort should be made to achieve this along the following lines.

Elimination of Poor Producers.

Although high-producing cows necessarily consume more feed than low producers, the former are more economical producers of milk and butter-fat since they utilize a much smaller percentage of nutrients for an equivalent yield of these products. It is therefore in the interest of every dairy farmer to eliminate poor producers.

Unfortunately, there are still far too many cows which are unremunerative, probably because owners are unable to judge which cows justify retention in the herd.

Milk records.—The only reliable method of determining which cows are economical producers, is to keep a milk record. If the milk yield is known and a definite feeding system is being followed, no difficulty will be experienced in determining whether a cow is remunerative or not.

The best way would naturally be to weigh and record each cow's milk separately every time she is milked, and also to have the butterfat content determined from time to time. Those farmers who are unable to do this, can at least record the milk production of each cow on three successive days every month *throughout the year*. The recording of milk yields at longer intervals is not of much value since that would fail to indicate which cows are capable of producing a constant good yield. Do not be misled by a relatively high peak production since this does not count for much if the animal concerned is unable to maintain a high level of production.

This is essential since production is very definitely influenced by feeding and treatment. It is of the utmost importance therefore to determine what the maximum production of each animal is and to feed strictly according to her yield. Many dairy farmers are apt to forget that unless a cow receives sufficient feed to ensure maximum production, the quantity available for utilization in the production of milk is naturally reduced since a definite amount of nutrients is required in the first place for her maintenance.

On the other hand, any surplus constituents given to an inferior cow will merely be stored up in her body as fat. In order to avoid the uneconomical consumption of feed, it is therefore of the utmost importance that farmers should feed their cows strictly according to production since such a system, accompanied by the elimination of low producers, will contribute in no small measure towards the most effective utilization of available nutrients.

Such a system could easily be carried out in practice by any unskilled labourer without his having to weigh off the quantity of feed required by each animal. All that the farmer has to do is to use a standard bucket or tin and to indicate by means of a number of strokes at each cow's stall or feeding place, or in some other readily understood manner, the number of bucketfuls or tinfuls to be given. If the farmer finds even this impracticable, he can at least divide his cows into groups having more or less the same production, and supply the cows of a particular group with an equal quantity of feed, based on their average production.

Quality of Feed.

For economic feeding, an adequate quantity of feed is by no means the only requirement. In many cases where sufficient feed is apparently supplied, the milk production remains unsatisfactory. This is usually due to a deficiency of one or more of the essential constituents of which proteins are the most important in so far as dairy cows are concerned, since milk has a high protein content and our usual rations are relatively low in this respect.

As adequate quantities of protein-rich feeds are practically unobtainable at present, it is the duty of dairy farmers to make every effort to produce those feeds which will supply the necessary proteins.

Naturally, a variety of protein-rich feeds will always be more effective since different kinds of proteins are required. In the case of unbalanced feeds, surplus amino-acids will inevitably be wasted. Consequently, a well balanced ration, having 16 per cent. protein content, will be much more effective than an unbalanced ration with the same percentage of proteins.

In order to economize as much as possible on the more expensive protein rich feeds, it is always useful to provide as much roughage of good quality as possible.

Succulent feed is also necessary since it maintains the digestive system in good order owing to its cooling and slightly laxative effect, and should therefore always be supplied. One of the best succulent feeds to use is good silage which is palatable and appetizing. Cows which receive silage will consume larger quantities of roughage, with the result that more nutrients will be made available for milk production.

One of the first considerations in regard to nutrition, is naturally the adaptation of the system of feeding to local conditions. Since summer and autumn grazing in the winter-rainfall area is exceedingly poor, hardy green feeds like kale and rape, mangolds and kaffir watermelon should be grown where possible. Dryland lucerne should also be sown and pastures established wherever possible.

These crops, together with silage which is easy to make, should constitute the basis for feeding in the winter-rainfall area, and all dairy farmers should make serious efforts to produce the required crops for these periods of scarcity.

If good rains fall early in the year, adequate grazing will be available during winter; young grass, which contains a fair percentage of readily digestive proteins, has a high nutritive value for cows. The same applies to a normal spring when grazing is usually at its best and hardly any supplementary feed is necessary.

Summary.

So much has already been written on the subject of rations, etc., for dairy cattle, that any further discussion here is unnecessary since the reader can find the necessary particulars in previous issues of *Farming in South Africa*.

It is most improbable that conditions will improve in the near future, and it will therefore be in the interest of every dairy farmer to pay attention to the following points:—

(1) Keep milk records and eliminate poor producers.

(2) Feed each cow according to her milk yield.

(3) See that the ration satisfies the necessary requirements.

(4) Make every effort to be self-sufficient in so far as feeds are concerned.

How to Test the Seeding Rates of a Grain Drill.

Dr. P. D. Henning, Senior Lecturer in Agronomy, Stellenbosch-Elsenburg College of Agriculture.

FOR economic production of grain, the seed and fertilizer must be sown at optimum rates. Many farmers, however, do not know at exactly what rate the seed or fertilizer is actually sown. Most of them simply estimate at what rate the drill sows or otherwise they sow according to the directions usually supplied with each machine. These directions cannot be relied upon since it is impossible, when compiling them, to take into consideration the annual variation due to the condition of the seed and fertilizer. The size of the seed, the moisture content and fineness of the fertilizer and the gradual wear of the drill, all contribute towards a variation in seeding rate from year to year.

The seeding rate of any drill can very easily and quickly be tested and adjusted and no farmer should take his drill to the land before this has been done.

In order to determine the seeding rate it is only necessary to know the number of revolutions the wheels make in putting one morgen under seed. The following data are necessary:—

(1) The circumference of one of the wheels.

(2) The seeding width of the machine. (*N.B.*—The seeding width is the distance from the centre of one wheel to the furthermost seed spout.)

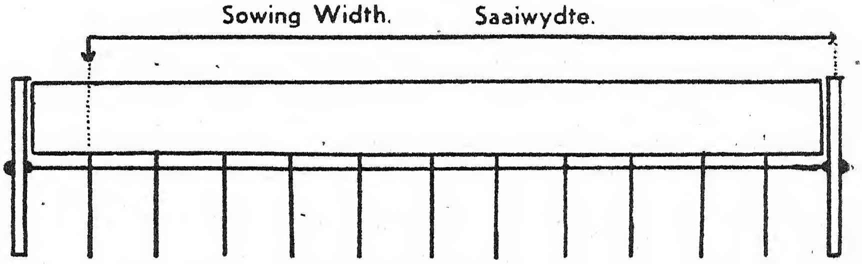


Fig. 1.—Drawing showing the seeding width of a drill.

After these measurements have been determined, it is possible to calculate the area sown during one revolution of the drill's wheels and from the result, the number of revolutions taken to sow one morgen. The whole procedure can be explained very clearly if a machine with the following measurements is taken as an example:—

Seeding width of drill $= 11\frac{1}{2}$ ft.

Circumference of wheel $= 12\frac{1}{2}$ ft.

Area sown during one revolution of wheels

$$= \frac{23}{2} \times \frac{25}{2} \times \frac{1}{9} \text{ sq. yd.}$$

$$= 16 \text{ sq. yd.}$$

The number of wheel revolutions required for sowing one morgen is found by dividing the area of 1 morgen (10,000 sq. yds.) by the area sown during one revolution. In this particular instance it is—

$$= \frac{10,000}{16} \text{ revolutions}$$

$$= 625 \text{ revolutions.}$$

Once the number of revolutions is known, the rest is easy. The drill is placed on a level piece of land so that the seed or fertilizer hopper stands absolutely perpendicular. The seed or fertilizer is then put into the hopper concerned and one wheel of the drill is jacked up, a few old bags or an old piece of canvas is placed under the seed spouts and the drill is set into motion. The jacked-up wheel is allowed to revolve 625 times, and the seed or fertilizer sown on the bags or sail will equal the amount that the drill would sow per morgen. If the seeding rate is found to be incorrect, the gears should be adjusted and the process repeated. The entire test should not last longer than 20 to 30 minutes.

The same procedure can also be adopted where a mixture of seed and fertilizer is sown, e.g., lucerne and superphosphate or Rhodes grass and superphosphate.

Tying a piece of rope or rag to one of the spokes of the jacked-up wheel, makes it easy to count the revolutions of the wheel.

Rape:-

[*Continued from page* 158.

be gradually accustomed to the new feed, and at first must be allowed to graze on rape for short periods only and then preferably not when they are very hungry or thirsty. Nor is it advisable to put sheep to graze on rape when the plants are wet. As soon as the animals have become accustomed to this plant, they may be allowed to graze freely without any ill effects and will put on weight rapidly.

Rape for Silage Purposes.

When intended for silage, the rape-and-oats or rape-and-barley mixture should be cut when the cereal crop is in the dough stage, just before it changes colour.

Climatic conditions in the winter-rainfall area are very favourable for the cultivation of rape, provided the seed is sown in autumn in well-prepared soil. For the success of fat-lamb production, a rape pasture crop is practically indispensable since there are few other crops on which fat-lambs develop and put on weight as rapidly as on rape.

The Control of Virus Diseases in Tomatoes:—

[*Continued from page* 164.

days. Pull up all plants which show any signs of "krimpsiekte". Such plants should be destroyed or buried or. if the soil is soft, dug under on the spot. This operation should preferably be carried out early in the morning before the insects on the plants are active and liable to fly away. After the diseased plants have been handled, the hands should be thoroughly washed with soap before touching healthy plants.) Unless diseased plants are removed, they will infect the healthy plants.

(9) Once the plants have attained half or three-quarters of their full height, the practice of removing diseased plants may be discontinued. If the remaining stand is still too dense, it may be thinned out to the desired number of plants per morgen.

Established Grasses for the Winter-rainfall Area.

Dr. P. W. Vorster, Department of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

LUCERNE is the most important pasture grass for the winter-rainfall area, but can be supplemented with established grasses and clover varieties which can be grown where the soils are too sour and moist for the cultivation of lucerne. A considerable number of experiments have been carried out with a view to finding suitable grass and clover varieties for this area. Accordingly the cultivation and value of the most promising grasses are discussed briefly below, while an article dealing with the clover varieties appears elsewhere.

Preparation of the Soil.

Since pastures are usually established for a number of years, it is essential that special attention should be given to the soil and its preparation. The first essential is complete eradication of weeds, followed by thorough deep ploughing and repeated cultivations with disc-harrow, ordinary heavy harrow rollers, etc., until a fine and compact seed bed has been obtained. In order to exterminate certain weeds such as couch grass and sheep-sorrel, it is necessary to dry cultivate the soil, once or twice. Where fine seed is sown, particularly grass seed, the preparation of the seed bed is of the utmost importance. It is also important to make the soil as level as possible in order to facilitate cutting of the crop.

Farmers often enquire whether a grass variety exists which is capable of furnishing good grazing during the dry summer months on arid, sandy soil. Unfortunately no such ideal or "wonder" grass has yet been found. Most pasture plants, and particularly grass, yield very poor results on impoverished or exhausted soil. The more fertile the soil the better the grazing; and the more luxuriant the vegetation, the greater the palatability and nutritive value.

In poor soils stable manure or compost must first be applied at the rate of approximately 10 ton per morgen, as well as a phosphatic fertilizer at the rate of 400 lb. per morgen. If stable manure or compost is not available, 600 lb. of *mixture G. or H.* should be applied per morgen at planting time. In areas where the rainfall is high or where irrigation can be practised, heavier applications of fertilizer are necessary. Grass requires an abundant supply of nitrogen, and it is therefore essential to apply an annual top-dressing of Chili saltpetre or ammonium sulphate at the rate of about 200 lb. per morgen in spring (for summer grasses) and in autumn (for winter grasses), unless the soil is so fertile that no nitrogenous fertilizer is necessary.

Although grasses grow better on acid soils than lucerne, they also prefer sweet soils. If the soil is very sour, the application of lime would be beneficial. Not only will the grasses grow better on such soil, but their palatability and nutritive value will also be enhanced.

Certain grass varieties require greater soil fertility than others, e.g., Kikuyu and rye grass thrive only on fertile soil, while Yorkshire Fog will grow fairly well on very much poorer soils.

The Establishment of a Pasture.

The most economical method of establishing a pasture is by means of seed, provided the price of the seed is not prohibitive.

Unfortunately, many grass varieties set practically no seed, so that it is necessary to propagate them by means of roots. This greatly increases the cost of establishing such pastures since the grass concerned must first be cultivated in a nursery, and when sufficient roots are available these must be lifted, broken up ,and then transplanted. Sometimes a grass variety can be established by means of seed, but there is the possibility that the seed will not be available as for example in the case of Makarikari, Antelope and du Toitskraal setaria grass. In such cases it is advisable to establish a small nursery of the grass by means of roots from which the necessary seed can be produced. It is essential that such a grass nursery should be laid out on very fertile soil so that the grass will grow and increase rapidly. If irrigation is not possible, the soil selected should be capable of retaining moisture for a long time.

The grass roots may be planted with a spacing of 2 ft. in rows 3 ft. apart. Trailing or creeping grass varieties such as *Panicum repens* and kikuyu should be planted further apart than the clumping varieties such as du Toitskraal setaria. It is essential to press the soil down well after the grass roots have been planted. If the soil is not damp, it must be watered or irrigated immediately. The roots of grasses like kikuyu and *Panicum repens* may also be cut, broadcast over the land and worked into the soil by means of a disc-harrow, after which the land may be rolled.

Where seed is sown, it is not always easy to broadcast it directly by hand, since many of the seeds are very light and fine and, in addition, the rate of seeding is usually rather thin. It is a good practice to mix the seed with clean, fine sand or with a fertilizer such as superphosphate, and then to broadcast it by hand. Where a larger piece of land is to be sown, the easiest course is to mix the seed with a fertilizer and then to sow the mixture through the fertilizer hopper of a sowing machine.*

As grass seed is very fine, the seed bed must be well prepared. The seed should be very lightly covered by means of a light blunt-tined harrow, a chain, or even a branch. Sometimes the use of a roller will suffice.

Grazing and Further Treatment.

It is usually advisable not to allow grass varieties to be grazed during the first year, so that they may first be given a good opportunity to become well established. After this grazing should take place according to local circumstances and the condition and nature of the grass with due regard to the following general principles:—

The palatability, as well as the nutritive value, of young grass is always greater than that of old and mature grass. Some grasses are eaten by animals only while they are very young, while other varieties retain their palatability for a long period. Sheep prefer very short grazing while larger stock prefer taller grazing. Sometimes it may be necessary to allow the tall grass to be grazed down by larger stock before placing small stock on it. Some grass varieties such as, for example, Makarikari, are so palatable that they may easily be overgrazed. Where possible, the grasses should be cut for hay or silage in spring or early summer, and the aftergrowth grazed off. At that time of the year grazing is usually abundant in this area, making it possible for the spring growth of the grasses to be conserved in the form of hay or silage for times of scarcity, namely

* See: Testing a seeding machine for rates of seeding, etc., by Dr. P. D. Henning in this issue as also "Sowing of Rhodes Grass" by N. L. Smit, "Farming in South Africa" November 1938.

January to April. In all cases it is necessary to apply a system of rotational grazing so as to utilize the available grazing to the best advantage.

It is advisable to harrow the grazing every year with a chain-harrow in order to break up and evenly distribute the animals' manure.

If the greatest benefit is to be derived from the grazing, it is essential that constant attention should be given to it. The method of grazing and treating each kind of pasture grass must be carefully studied. A good pasture should not be regarded merely as a place on which to keep animals.

FIG. 1.—Grass varieties at the Experiment Farm on the Cape Flats.

Winter Grass Varieties.

Climatic conditions in the winter-rainfall area are favourable for pasture crops which have their growing period during autumn, winter and spring and remain in a dormant or semi-dormant condition during summer.

On the whole, therefore, the winter grasses are of greater importance in this area than summer varieties.

Phalaris tuberosa, is one of the most important and valuable grasses in this area. It grows out rapidly after the first rains in autumn, continuing to grow throughout the winter until early in summer. During the dry summer months it remains in a dormant condition, and is consequently able to survive the unfavourable summer conditions better than the other winter grasses like tall fescue and cocksfoot. It is one of the first grasses to provide grazing in autumn or early winter after the first rains, and is a tufted grass which can be very heavily grazed under favourable conditions. In addition, it is very palatable and thrives best on rich, fertile soils. The best time for sowing is in autumn, and the usual rate of seeding varies from 5 to 8 lb. per morgen.

Tall Fescue (*Festuca elatior* and *F. arundinacea.*). This variety is also an erect, vigorous growing, tufted grass, which, although

perhaps slightly harder than *Phalaris tuberosa,* is fairly palatable to stock, particularly large stock. Under very wet winter conditions, it gives better results than Phalaris. It appears to thrive particularly well on the Cape Plate, where the soil is sandy and inclined to become very wet in winter. If sufficient moisture is available in the soil, this grass remains green until well into the summer. On rising ground at Elsenburg, however, this grass does not stand the dry summer conditions as well as *Phalaris tuberosa.* After being cut for hay, tall fescue still continues to provide abundant grazing. It also gives a better aftergrowth than Phalaris. This grass should be sown in autumn at the rate of 30-40 lb. per morgen.

Rye Grasses (Lolium Spp.). Of all the rye grasses, the Italian variety is the most suitable for this area. There are few farms on which this grass does not grow wild in winter and spring, particularly in parts where the rainfall is high.

It is, however, a grass which is partial to rich soils with a high nitrogen content. Furthermore, it grows well under very wet conditions. At Elsenburg it is one of the most important grasses in the vleis which become very wet in winter. On the other hand, however, it is very sensitive to dry hot weather. It grows exceptionally rapidly during the late winter and spring and furnishes very palatable grazing; it also gives a first-rate hay, but should not be cut too late, since there must be sufficient aftergrowth to set seed for the next year's crop; nor should it be grazed so heavily late in spring, that it is given no chance to produce seed. It is an annual and if unable to run to seed, should be sown again in autumn at the rate of 20-25 lb. per morgen.

Cocksfoot (Dactylis glomerata). Although this grass also furnishes abundant grazing during winter and spring, Phalaris tuberosa and *Tall Fescue* yield better results at most places, and are also more resistant to drought.

The usual sowing time for *Cocksfoot* is also during autumn, the rate of seeding ranging from 20-25 lb. per morgen.

Yorkshire Fog (Holcus lunatus). This winter grass is not as palatable as Phalaris, but can be cultivated on considerably poorer soil than most other grass varieties. It thrives well in a cool, moist climate and is easily scorched by the sun in summer. This grass can be cultivated in areas where the summers are not too dry and hot and where the soil is too poor for the other grasses as, for instance, along the mountain slopes in the Caledon-Bredasdorp and south-western districts. It should be sown in autumn at the rate of 20-25 lb. per morgen.

Summer Grasses.

Climatic conditions in the winter-rainfall area are not very suitable for summer grasses. Only in areas where the winter rainfall is very high and where the grass varieties are planted on deep, cool soils which remain moist until far into the summer, or where the summers are not as dry and hot as in the Caledon-Bredasdorp, and south-western districts, can these grasses be cultivated with any degree of success. In the Swellendam-Riversdale area, where rains generally occur during summer and autumn as well, a summer grass like Rhodes grows extremely well. Experiments conducted at the Langgewens Experiment Farm have revealed, however, that the rainfall in the Swartland area is not only too low, but the summers are also too dry and hot for any of the summer crops to be successfully cultivated there. Grasses which remain green in winter and

which even put on a little growth are always preferable to those which provide no grazing in winter.

Napier Fodder or Elephant Grass and Mfufu grass (*pennisetum purpureum*). These grasses attain a height of 6 to 10 ft. and even more. They are course and the stems of old plants become so hard that animals find it difficult to eat them. These grasses grow out very rapidly during spring and summer and are eminently suitable for green feed and silage purposes. They can also be grazed, provided that they are not allowed to reach too great a height. So palatable are the young shoots, however, that the plants are very liable to be over grazed and killed. They do not grow during winter and are even killed by frost.

These grasses require fertile soil and abundant moisture, yielding particularly good results along water-furrows or sluits, and are

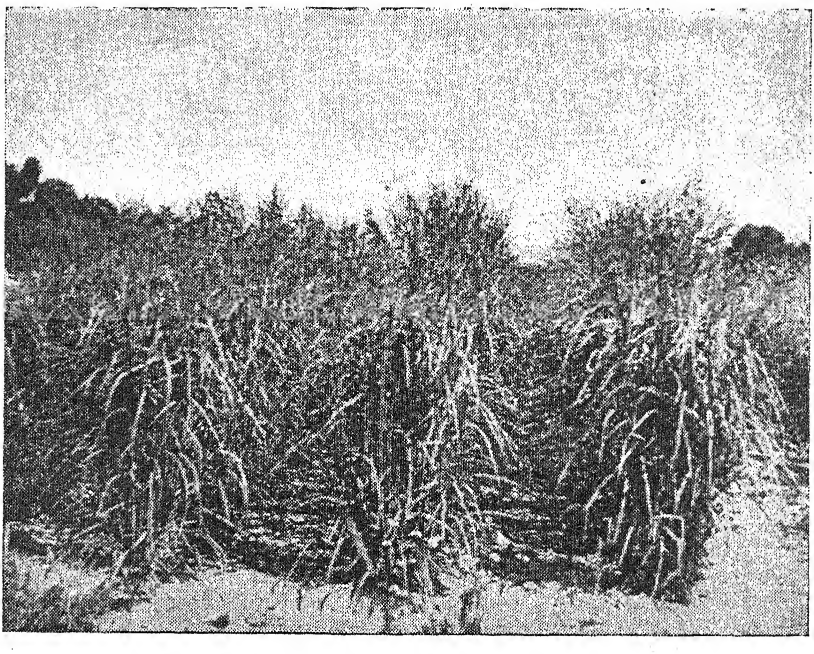


FIG. II.—Antelope grass, 5 ft. high, 3 months after roots had been established. Cape Flats.

also eminently suitable for wind-breaks. These grasses are planted early in spring by means of roots. The rows may be 4 ft. apart and the plants 2 ft. apart in the rows.

Limpopo Grass (*Echinochloa pyramidalis*) is another very strong erect-growing grass which is suitable for green feed. Although not as course as Napier fodder, it also becomes hard and unpalatable when old. For grazing purposes, it should therefore be kept short, but at the same time overgrazing should be guarded against. It does not make much growth during winter, but grows out rapidly during spring. An important characteristic of this grass is that it can stand very wet conditions, and can therefore grow where the soil is too wet for most other grasses. It is also established early in spring by means of roots.

Antelope grass (*Echinochloa pyramidalis*). This grass differs from Limpopo grass only in that it has finer leaves and stems and that it does not attain as great a height, although it sometimes reaches a height of 4-5 feet. It may also be utilized for green feed and silage, as well as for hay, in which case the aftergrowth can be grazed. A very valuable property of the grass is that it can stand excessive moisture in winter. It remains green throughout the winter and grows out rapidly in spring. It would seem this variety appears to thrive well on the Cape Flats and in places with a high winter rainfall. It may be established either by means of roots or from seed. Since the seed sometimes germinates poorly, it must be sown fairly densely, at the rate of about 40-50 lb. per morgen. The seed has not yet been placed on the market, and farmers will have to produce their own seed requirements. The best time for sowing or planting is early in spring.

Natal grass (*Pennisetum unisetum*) is an exceptionally hardy, tufted grass which is capable of standing a considerable degree of cold and drought. Although it does not make much growth in winter, it remains green in most parts of the western Cape Province and can be grazed. It is apparently not as palatable as some other grasses, but is fairly readily eaten by animals, particularly large stock. If cut for hay, the aftergrowth may be grazed. This grass is one of the few which remain green throughout the year under dryland conditions at Elsenburg. It is established by means of roots, the best time for planting being early in spring.

Du Toitskraal setaria is a tufted grass which not only remains green during winter, but even makes slight growth during that season. It grows out rapidly early in spring and appears to be a promising pasture grass. If the growth is luxuriant, the grass may be used for making hay and the aftergrowth grazed. The grass may be established either by means of roots or from seed. The seeds of this variety are not yet obtainable on the market, and farmers will have to produce their own seed. Spring is the time for sowing or planting this grass.

Rhodes grass (*Chloris gayana*) is a grass which has become extremely popular in the south-western districts during the past few years. It is a typical summer grass, and cannot stand cold. During winter it does not provide much grazing but during spring and summer it grows luxuriantly and rapidly covers the soil. For small stock the grass must be grazed short otherwise they will find it unpalatable. It is established by means of seed at the rate of 15-20 lb. per morgen. The best time for sowing is late in spring when the soil has warmed up since it germinates very poorly in cold soil.

Makarikari (*panicum sp.*) is a grass with a semi-creeping habit and is fairly hardy and capable of withstanding a considerable degree of drought and cold. It remains green and even makes slight growth in winter, growing out rapidly in the early spring. This grass is not partial to any particular type of soil. Owing to its palatability, the grass is very liable to be overgrazed, particular since its runners are not firmly anchored to the soil. It can be grown in spring from seed sown at the rate of about 30-50 lb. per morgen. The seed of this variety is not yet on the market and it will be necessary for farmers to produce their own requirements.

Paspalum (*Paspalum dilatatum*) is a grass which thrives best on low-lying soils and in vleis, which remain moist until late in summer. It is capable of standing considerable moisture and remains green in winter. If the soil remains moist for a long period the grass can be

very heavily grazed, the best results being obtained if it is grazed while short. The seed is sown in spring at the rate of 20-25 lb. per morgen.

Kikuyu (*Pennisetum clandestinum*) is a creeping grass which rapidly anchors itself to the soil. As it is very difficult to eradicate this grass, it should not be planted on soil which is likely to be utilized for the cultivation of other crops later on. Kikuyu yields good grazing only on fertile soils with a high nitrogen content, which retain moisture for a long time. Under favourable conditions it has a high carrying capacity and may be heavily grazed. It is suitable for planting in small paddocks which serve as an excercising ground for animals, since it is not easily trampled out. It is not resistant to cold, however, with the result that it becomes yellow and unpalable in winter and does not provide much grazing during this period.

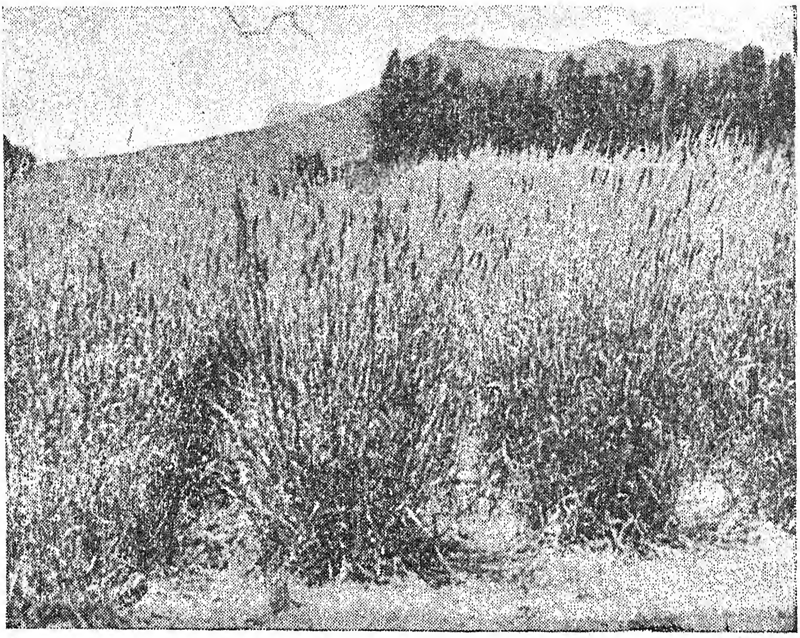


Fig. III.—Phalaris tuberosa in full seed, 5 ft. high, Welgevonden Experiment Farm, Stellenbosch.

It is a very useful grass for planting on soils which must be protected against erosion or for binding contour banks, stormwater training banks and dam embankments.

The grass must be established in spring by means of roots.

Panicum repens is also a creeping grass the rhizomes of which rapidly penetrate the soil. This grass too should not be grown on soil which is likely to be planted to other crops later on. The grass has no special preference for any particular type of soil; all that it requires is a fertile soil. It may be successfully utilized for binding sandy soils, if provision is made for sufficient stable manure or compost. It is capable of standing considerable moisture.

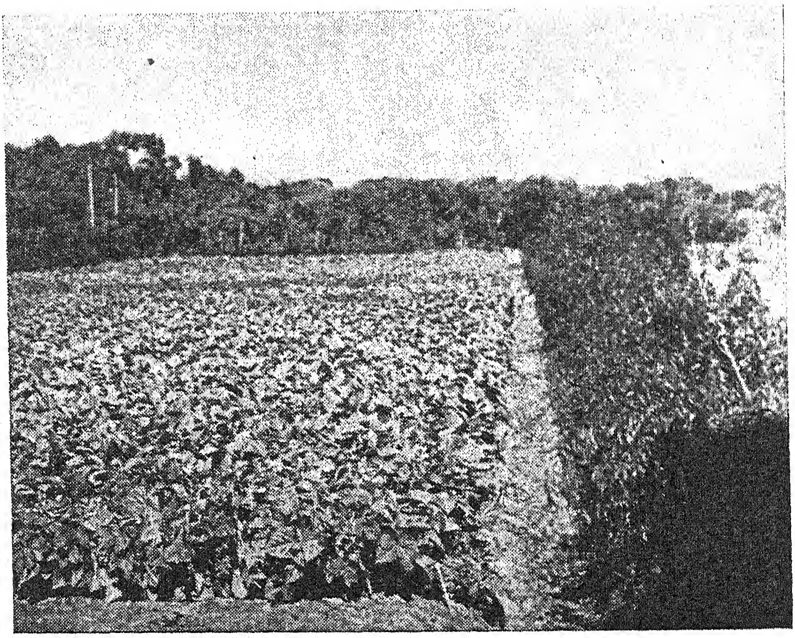
This grass is also established by means of roots, the best time for planting being early in Spring.

A Sowing Chart for Vegetables in the Winter Rainfall Area.

Dr. P. W. Vorster, Department of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

The Importance of Vegetables.

WAR conditions have resulted in an intensified demand for vegetables. Convoys take in large quantities at our ports while the army also uses an enormous amount. In addition, considerable quantities of vegetables are canned and dehydrated for our troops outside the Union. As a result of this growing market the prices of most vegetables have rapidly increased during the past few years. Consequently, a particularly lively interest is to-day being



Bean-variety, Cape Flats.

displayed in the cultivation of vegetables even by persons who paid very little attention to the matter in the past.

Although the economic significance of the vegetable industry should not be underestimated, the importance of vegetables should not be gauged solely by the cash income derived from it. The rôle played by vegetables in maintaining the health of our people is not yet fully realized. Fresh vegetables constitute one of the most important sources of the minerals and vitamins needed by the human system, and are of vital importance as a protective food.

Apart from the nutritive and healthgiving value of vegetables, gardening provides not only very healthy relaxation and recreation but also considerable pleasure and enjoyment for the whole family, especially those members who have to spend the greater part of the day in the schoolroom, office, shop or factory. Neither can the

educational value of the vegetable garden in the development of the child be over-estimated.

Every townsman should aim at having his or her own vegetable garden. The ideal should be: " A garden for every family and every family in a garden ". It is not very difficult to grow most types of vegetables, and sufficient vegetables for the whole family can easily be raised on a small plot.

A sowing chart for vegetables in the winter-rainfall area is given in the following pages for the guidance of those who have not had much experience in the growing of vegetables.

General Observations.

In the winter-rainfall area climatic conditions vary not only from year to year, but also from place to place. Consequently, the sowing and planting times given in the above sowing chart do not necessarily apply to every district and place but should be regarded only as a general guide.

Where water for irrigation purposes is not available, it will usually be possible to grow only winter and spring vegetables. On every farm, however, and even on grain farms, vegetables should be available for home consumption until the summer is well advanced if low-lying soils are used and if thorough soil cultivation and strict weed control are practised.

A few of the most important vegetable varieties are given under each type of vegetable. Under beans, beetroot and peas, those varieties which are most suitable for canning, are also given. It may be that these varieties, especially the beans, do not give such high yields as the other varieties, but they usually realize higher prices. As the canning and dehydrating industries develop and expand, increasing attention will have to be given to those vegetable varieties which are most suitable for this purpose.

In the present circumstances, it may sometimes be difficult to obtain seed of all the vegetables mentioned, and it is, therefore, very necessary that farmers should use vegetable seed as economically as possible. It is a very wise practice to test the germinating power of each sample of seed beforehand and to regulate the rate of seeding accordingly. This rate can usually be considerably reduced if the seed bed is thoroughly prepared and if measures to control insect pests and diseases are applied in good time. The rate of seeding is also largely determined by the season and the type of soil. Where winds sometimes cause damage, windbreaks must be provided in time.

Such crops as beetroot, swiss chard, lettuce, spinach, carrots, parsnips, turnips, radishes, kohl-rabi, salsify, etc., must be thinned out to the desired stand in time, i.e., when the plants are approximately one inch high.

The distance between rows and between plants in the rows will also be determined by circumstances. Where animals are used for inter-row cultivation, the rows must be much further apart than where the work is done manually. If the vegetables grow luxuriantly, i.e., if the soil is fertile, the plants need more room for development. The plants of dwarf varieties can be planted closer together than tall varieties of the same type of vegetable.

The accompanying sowing chart is far from complete since only the better known vegetables are given. Lack of space has also rendered it necessary to make the list as concise as possible.

SOWING CHART FOR THE MOST IMPORTANT VEGETABLES IN THE WINTER-RAINFALL AREA.

Vegetable.	Variety.	Sowing Time.	Transplanting Time.	Distance between Rows.	Distance between Plants.	Sowing Depth.	Amount of Seed Required. Per Row of 100 ft.	Amount of Seed Required. Per Morgen.
				Inches.	Inches.	Inches.		
POTATOES	King George Arran Banner Green Mountain Dunbar Standard Kathadin Up-to-date	Spring Crop, July–Sept. Autumn Crop, Feb.–Mar. Winter Crop, May	—	24–33	12–15	4–5	10–15 lb. (2-oz. seed potatoes)	25–45 bag (2-oz. seed potatoes)
ASPARAGUS	Mary Washington	August–September	June–Aug. (year-old roots)	48–60	18–24	½–1	1 oz.	10 lb.
BEETROOT	Improved Dark Red* Detroit* Flat Egyptian	February–April July–November	Thin out	18–24	2–3	¾	2–3 oz.	10–12 lb.
BROADBEANS	Broad Windsor Long Pod Hangdown Long Pod	April–June	—	30–36	9	2–3	5–8 oz.	100–150 lb.
BEANS (Green)	Dwarf beans:— Afrikander (Victory) Long Tom Canadian Wonder Kudu stringless* Full measure* Tendergreen* Refugee* Burpee stringless* Chestnut greenpod* Butter beans:— Yellow Podded Wax Golden Podded Wax Mont de'Or Butter	September–February	—	20–24	3	2–3	10–16 oz.	100–150 lb.
	Runner beans:— Eksteens-runner Morse's Pole* Kentucky Wonder*	September–January	—	36–48	6	2–3	5–8 oz.	50–70 lb.
CAULIFLOWER	Southern Cross Veitch Autumn Giant, Italian Giant (early and late)	December–February	February–April	36	30–36	¼–½	a packet	10–16 oz.
EGG-FRUIT	Long Early Purple New York Spineless	August–September	October–November	36	24	¼–½	½ oz.	12 oz.
PEAS	Greenfeast* Perfection* Emperor* Stomppeul Wiehahn's Crescent*	April–August	—	24–30	2–3	2–3	1 lb.	150–250 lb.

* Good canning varieties.

Vegetable.	Variety.	Sowing Time.	Transplanting Time.	Distance between Rows.	Distance between Plants.	Sowing Depth.	Amount of Seed Required. Per Row of 100 ft.	Amount of Seed Required. Per Morgen.
				Inches.	Inches.	Inches.		
CUCUMBER............	Evergreen.................... Early Fortune.............. Chicago Pickling............ Zeppelin....................	September–October	—	72	48–60	1–1½	½–1 oz.	4–6 lb.
CABBAGE.............	*Early:* Copenhagen Market, Jersey Wakefield................... *Med. early:* Spitskool....... *Med. to late:* Savoy and "drum and ball head" types	Autumn Crop, Nov.–Jan. Winter Crop, Feb.–April Spring Crop, June–July	December–March April–June August–September	30–36	18–24	¼–½	a packet	1 lb.
KOHL-RABI (Turnip Cabbage)	Early White................ Vienna...................... White Goliath..............	April–June	Thin out	24	6	¼–½	¼ oz.	3–4 lb.
MAIZE (Green mealie or Sweet corn)	Golden Early Market........ Golden Bantam............. Country Gentleman..........	September–January	—	36	18–24	1–2	4–6 oz.	15–20 lb.
VEGETABLE MARROW..	Evergreen................... Long Green Bush-marrow.... Long White Bush-marrow (also vine varieties of the above)	September–December	—	48	48	1–2	4 oz.	5–8 lb.
PUMPKINS............	Flat White "Boer".......... Fraserdale "Boer".......... Cape Sweet.................. Ceylon......................	September–November	—	96–108	96–108	1–2	1 oz.	4–6 lb.
SWEET POTATOES......	Borrie, Witpatat, Port Natal, Rondeblaar	—	Oct.–Nov. plant vines or slips	36	18	—	70–80 slips	7,000 slips
PARSLEY.............	Extra curled double.........	March–April and Sept.	May–June; Oct.–Nov.	18–24	6–9	¼–½	½ oz.	6–8 lb.
LEEKS...............	Broad Flag.................. Giant, Italian..............	April–May	August–September	24	6–9	¼–½	½ oz.	5–8 lb.
RADISHES............	Chinese Rose Winter......... French Breakfast............ Early Scarlet............... Globe.......................	March–November	Thin out	18	1–2	½	1 oz.	15 lb.
TURNIPS.............	American Purple Top......... Starkes Express............. White Stone................. Early White Milan..........	March–August	Thin out	18–24	3–4	½	½–1 oz.	5–7 lb.
CHILLIES............	Large Bell.................. Long Red....................	August–September	September–October	36	24	½	¼ oz.	12 oz.
RHUBARB.............	Victoria....................	September	2 root-crowns, May–Aug.	36–48	36	—	1–2 oz.	5 lb.
CELERY..............	Giant Pascal................ White Plume.................	February–March August	April–May September–October	30	6–9	¼	½ oz.	3–5 lb.

Vegetable.	Variety.	Sowing Time.	Transplanting Time.	Distance between Rows.	Distance between Plants.	Sowing Depth.	Amount of Seed Required. Per Row of 100 ft.	Amount of Seed Required. Per Morgen.
				Inches.	Inches.	Inches.		
SALSIFY (Black)	Black root	August–October	Thin out	—	—	1	2–3	12–16 lb.
(White)	White French	August–October	Thin out	18–24	3–4	1	2–3 oz.	12–16 lb.
SQUASHES	Little Gem (trailing)	September–November	—	72	72	1–2	1 oz.	3–5 lb.
	Golden Custard; Scallop (stem); Golden			48	48	1–2	2 oz.	4–6 lb.
	Hubbard (trailing); Hubbard, improved; Green (trailing); Table Queen (trailing)			72	72	1–2	1 oz.	3–5 lb.
LETTUCE	New York Special; New York Hybria; Webbs Wonder	August–November; February–April	—	18	4–6	$\frac{1}{4}$–$\frac{1}{2}$	a packet	5–7 lb.
SWEET MELON	Rocky Ford; Hale's Best; Bay View; Cape Winter	September–October	—	72	72	2	$\frac{1}{2}$–1 oz.	3–5 lb.
SPINACH— Winter	Bloomsdale	March–April	Thin out	18	4–6	$\frac{1}{2}$–$\frac{3}{4}$	2 oz.	12–16 lb.
Summer	Silver Beet:— Dark Green; Lucecllus	August–September. March–April	Thin out	24	9	$\frac{1}{4}$–1	2 oz.	12–16 lb.
	New Zealand	September–October.	Thin out	36–48	24	1	2 oz.	15–18 lb.
TOMATOES	Bonnie Best; Rutgers; Marglobe; Marvel	July–September	September–November	36–48	36	$\frac{1}{2}$	a packet	3–5 oz.
ONIONS	Australian Brown; Spanish Brown; Cape Straw Coloured; Early Flat Yellow, Cape (early)	April–May	September	15–18	3	$\frac{1}{4}$	$\frac{1}{2}$–1 oz.	5 lb.
WATERMELON	Cape Mountain; Sweet, Cape Ice; Cream, Tom; Watson; Florida Favourite	September–October	—	108	72	2	1 oz.	4–8 lb.
PARSNIPS	Hollow Crown; Short Sweet; Suttons Student	August–October; April	Thin out	24	3–4	$\frac{1}{4}$–$\frac{1}{2}$	1–2 oz.	8–10 lb.
CARROTS (Yellow)	Nantes; Cape Market; Chantenay	August–November; February–April	Thin out	18–20	1–2	$\frac{1}{4}$–$\frac{1}{2}$	$\frac{1}{2}$–1 oz.	4–6 lb.

"Doodgaansiekte", Fusarium-blight or Common Root Rot of Wheat.

G. J. M. A. Gorter, Department of Plant Pathology, Stellenbosch-Elsenburg College of Agriculture.

THE diseases in cereal crops which farmers generally know as " vrotpootjie " are actually a complex of diseases caused by a group of different fungi. All these diseases have one characteristic in common, viz., that the root system of affected plants is damaged or totally destroyed. This either impedes or prevents the absorption of water and nutrients and results in the wilting and early death of the plant. There is not much difference in the external symptoms produced by completely different types of fungi and, consequently, only

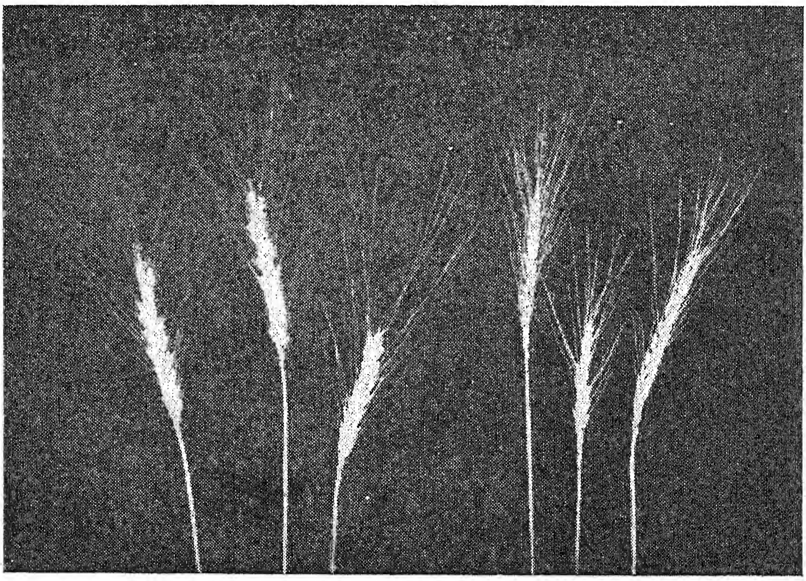


Fig. 1.—On the left and right three ears of healthy and diseased Hope Wheat plants respectively.

a careful study of the disease on the land as well as in the laboratory can enable the research worker to distinguish between the different causes. In a such-like examination it has been established that wheat in the south-western grain districts is attacked by at least two entirely different kinds of fungi, both of which cause root rot. Of these, the type known as *Ophiobolus graminis* is perhaps the more common. In spite of this, however, the term common root rot applies in concordance with international use to the disease caused by the other fungus which is a *Fusarium* species. Owing to the similarity in many respects between the symptoms produced by these two fungi, they were until recently not distinguished at all and vrotpootjie was frequently erroneously ascribed to *Ophiobolus graminis*. During the past few years, however, it has been ascertained that much of the damage caused by the so-called " doodgaansiekte " in the Bredasdorp and Caledon districts, is due mainly to a *Fusarium* fungus. It

is estimated that in years which were favourable to this disease, the yield on some farms was decreased by as much as 30 per cent.

Symptoms.

This disease is generally first noticed, and is also most injurious, when the plant is in the ear stage. Affected plants show a yellow discoloration a few weeks before harvesting time and die early. If the ears of such plants are rubbed in the hand, it will be found that they are blank and that no kernels or only a small number with a shrunken appearance, have been formed in the ears. This is clearly illustrated in the accompanying photographs, figures 1 and 2, in which are depicted the ears of healthy and diseased plants and the kernels they produced.

If affected plants are pulled up, the roots reveal dark brown, shrunken spots or a uniform light brown decay. Depending upon the degree of rotting of the root-crown, which is also very susceptible to attack by the causal organism, the plant can be pulled out fairly easily. As a rule, however, it is not as easy as in the case of plants which have been attacked by *Ophiobolus* foot rot. Characteristic of that disease is the pink discoloration which under moist conditions, is perceptible at the base of the stem as a result of the luxuriant growth of the fungus which weaves a network of threads on the surface of the plant. A further characteristic of the disease is the dark brown discoloration of the lower one or two internodes of the stem.

Cause of the Disease.

The causal organism of this disease is a fungus known as *Fusarium graminearum*. In the presence of adequate moisture this fungus fructifies on the basal parts of affected plants, forming an orange-coloured slimy mass of spores. Under dry conditions the spores are distributed far and wide by the wind and may adhere to healthy ears, infecting the grains at threshing time. Since the fungus is also capable of attacking seedlings, the sowing of such infected seed will result in a poor stand. As a rule, this stage of the disease is overlooked, since adjoining plants take the place of wheat plants which have died off.

Actually the fungus has two kinds of spores in its life cycle; one type serves to spread the fungus rapidly and the other, the so-called ascospore, ensures the survival of the fungus under unfavourable conditions. The ascospore stage was first encountered recently on wheat plants in the vicinity of Bredasdorp. These spores develop in the form of small, black pin-head shaped bodies on the basal internodes of plants which have died of the disease.

Spread of the Disease.

This common root-rot disease occurs in practically all the grain-producing countries of the world, but does not cause the same amount of damage everywhere. Apparently the injurious properties of the organism are closely dependent upon climatological conditions and the physical condition of the soil. Countries with a moist and hot summer climate are troubled to a greater extent by the disease than those experiencing more temperate summer temperatures. Drought and high temperatures at sowing time encourage the disease. Abnormal physical conditions of the soil, such as brackishness and a deficiency in copper, are very favourable for the development of the disease. In short, it may be said that all conditions which are unfavourable for a normal, healthy and strong growth of wheat plants will be favourable for the disease.

Control.

Since the causal fungus can live both parasitically and saprophytically, i.e. since it is also capable of surviving in the absence of living wheat plants and since the fungus presumably plays a part in the production of humus from straw in our wheat soils, it is very difficult to exterminate it in soils in which it already occurs. Actual control measures directed at minimising the damage caused by this disease must be based on the following points:—

Disinfection of Seed.—Dusting of infected seed with copper carbonate or organic mercury compounds such as Agrosan and Ceresan, will lead to increased yields. Even if the seed is free from

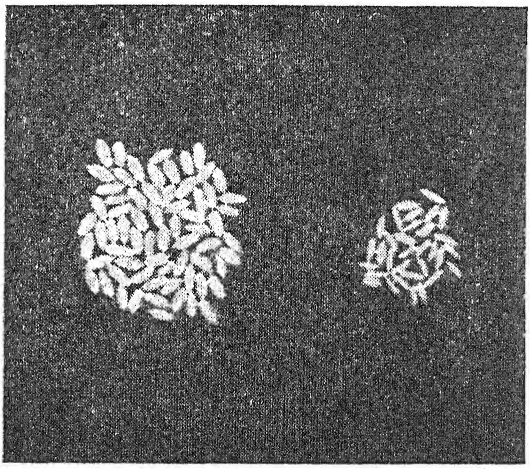


Fig. 2.—Left and right: Wheat grains rubbed out of the healthy and diseased ears (Fig. 1), respectively.

the spores of the fungus but is sown in infected soil, it is desirable to treat the seed with one of the above-mentioned mercury compounds in order to safeguard the germinated seed against the fungus in the soil.

Selection of Variety—While no wheat variety is completely resistant to the disease, all wheat varieties are nevertheless not equally subject to it. Experiments carried out up to the present indicate that late varieties, in particular, are subject to the disease. It is, therefore, recommended that farmers in areas where the disease is severe, should endeavour to sow only early varieties.

Fertilizing.—Judicious fertilizing which promotes a rapid normal growth of the plant will do much to keep the disease in check.

Rhodes Grass as a Pasture Crop.

N. L. Smit, Extension Officer, Riversdale.

RHODES grass (*Chloris gayana*) is a valuable perennial summer grass and a natural veld grass in certain hot, summer rainfall-areas of this country. It has been conclusively proved, however, that it can also be cultivated economically in cool areas such as the Riversdale, Heidelberg and Swellendam districts, provided the summer rainfall is not too low. In view of the present shortage of labour, fertilizer, fuel, machinery, etc., farmers should make more use of this grass in order to re-organise their farming operations on a sound economic basis.

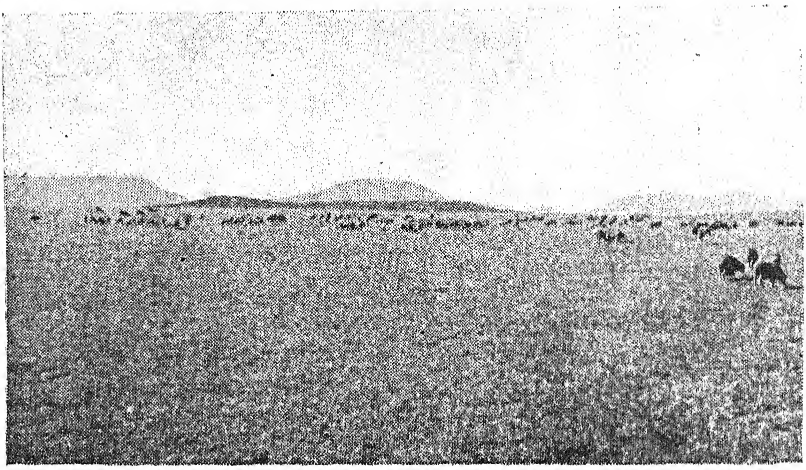


Fig. 1.—Rhodes grass as grazing for sheep on land unsuitable for wheat.

Nutritive Value of Rhodes Grass.

The cultivation of Rhodes grass does not completely solve the pasture problem since this crop provides only dry winter grazing. Observations over the past five years have shown, however, that Rhodes grass answers to the following important requirements:—

(1) The grass is easily and therefore economically established from seed and can withstand very unfavourable conditions.

(2) Under normal conditions the cost of establishment is covered by the grazing provided during the very first season, thus ensuring a quick return for the farmer.

(3) Weed encroachment, soil erosion and leaching are prevented by the vegetative cover which the grass provides.

(4) The grass can be kept for periods of scarcity since it does not lose its leaves and retains its high nutritive value in the dry form.

(5) It is free from insect pests and fungus diseases and provides healthy grazing for animals.

(6) The grazing it provides is not only eminently suitable for large stock like cattle, mules and horses, but is also excellent for sheep if grazed short.

(7) It can stand severe grazing and is permanent. Grass which has been grazed short by sheep over a period of 5 years, still shows a good stand.

(8) The grass grows extremely well on the poorest wheat lands and has a high carrying capacity. On soil which was given a

fertilizer application at the rate of 200 to 400 lb. super-phosphate per morgen at planting time, and which received no further cultural treatment, Rhodes grass provided grazing over a period of 5 years averaging from 1000 to 1800 sheep days (3 to 5 sheep per morgen per day) per morgen per year. The carrying capacity increases in relation to the summer rainfall from west to east.

(9) The nutritive value is high as is indicated by the following analyses of grass obtained from the Riversdale district:—

TABLE 1.—*All results on absolutely dry basis, except moisture.*

Growing Time.	Length of Leaf-growth.	Crude Ash.	Crude Fibre.	Crude Protein.	True Protein.	Phosphorus Pent-oxide.
	Inches.					
3rd Year.........	3	9·979	22·254	16·949	13·971	0·881
3rd Year.........	7	10·524	23·644	13·139	10·380	0·568
3rd Year*........	15	7·694	28·700	4·264	3·225	0·433

* The grass was practically dry.

The grass was sown in September 1937 on soil that was too poor for the cultivation of wheat. The soil is moderately rich in nitrogen but has a very poor phosphorus and potash content as is shown by the following analyses of soil samples taken in July 1939:—

TABLE 2.—*Analysis of Soil Samples from Riversdale.*

	pH.	Nitrogen.	Per cent. available P_2O_5 (Phosphorus Pentoxide).	Per cent. available K_2O (Potash).
Top soil.......	6·54	0·119	0·0050	0·0026
Sub-soil........	8·46	0·079	Not determined	Not determined

The following fertilizer applications were made:— Sept. 1937: 400 lb. super-phosphate per morgen, broadcast together with the seed; Sept. 1938. 200 lb. super-phosphate and 100 lb. ammonium sulphate per morgen, broadcast on top of the soil without cultural treatment.

It is clear from table 1 that the protein and phosphorus content of young, green Rhodes grass is high and that it compares very favourably even with green lucerne. This protein and phosphorus content rapidly decreases as the grass matures, but it has been found that mature, dry pasture is still very valuable for full-grown and non-producing animals and that it will at least maintain them in good condition. The pasture is at its weakest during the period July to September, but experiments with subterranean clover mixed with Rhodes grass give reason for entertaining the hope that it will be possible in future to utilize this as a succulent, protein-rich crop to supplement dry grass pastures during winter and spring. It was also found that the clovers definitely have a beneficial effect on the growth and quality of the grass during summer. A mixture of early and mid-season subterranean clover varieties is sown after a good rain during March and April at the rate of 5 to 10 lb. per morgen

on established Rhodes grass pasture. The soil is then lightly disced and cultivated or harrowed. Lucerne is another protein-rich crop that can be sown together with Rhodes grass at the rate of 15 lb. per morgen; although it provides very little winter grazing, it is valuable as supplementary grazing during autumn and Spring.

It is therefore clear from the foregoing that Rhodes grass can play a very important part in rectifying the present position. Since it can be cultivated economically on impoverished soil and on soil that is unsuitable for the cultivation of wheat, the farmer can use his best lands for the cultivation of wheat and other grain. This will also ensure economic stock farming and the gradual improvement of soil fertility.

Preparation and Fertilizing of Soil.

Rhodes grass will grow on a variety of soils, ranging from sand to clay, but in the south-western districts of the Cape Province it seems to prefer the Bokkeveld shale soils which are incidentally also the poorest wheat soils. The question of fertilizing has not yet been

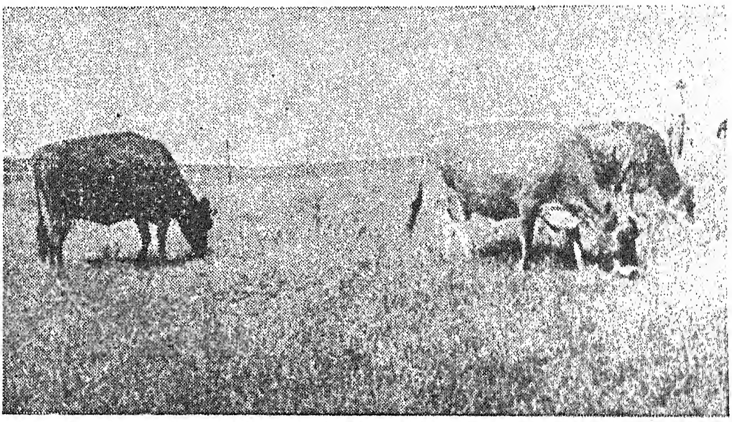


Fig. 2.—Cows on Rhodes grass. Note their good condition after 4 months (July-Oct.) on Rhodes grass alone without any supplementary feed.

settled and since it was assumed that phosphatic fertilizers would be necessary on account of the low phosphorus content of the soil, 200 to 400 lb. of phosphate per morgen was applied at planting time. It is interesting to know, especially under present conditions, that some farmers have cultivated this grass with good results without the use of phosphates and many now use only fine Karroo manure when sowing the seed.

A good seed-bed is very essential for the successful cultivation of Rhodes grass. An effective method to adopt is to plough the soil a good while in advance so that it can be cultivated to a fine tilth at any later date. Once the soil is fine, the remaining cultivations must be shallow in order to destroy weeds of which quickgrass (*Cynodon dactylon*) is the most troublesome, and also to get the surface layer fine and firm. When the seed is sown the soil must be so firm that a person can walk over it without leaving impressions. The harrow is a very handy instrument for this purpose and cannot be used too frequently.

Sowing the Seed.

As in the case of practically all summer crops, Rhodes grass requires hot and moist conditions for germination and growth. The

[*Continued on page 200.*

Disinfecting Winter Cereal Seed against Smut and other Diseases.

G. J. M. A. Gorter, Department of Plant Pathology, Stellenbosch-Elsenburg College of Agriculture.

TAKING into account the high cost of production and the current prices of cereals, grain farmers must come to the conclusion that the wisest course to follow is to disinfect all grain seed with the best materials procurable and in accordance with the correct methods. As a rule, the only reason for disinfecting seed is to control smut, but several other diseases can be spread through seed and may in that way bring about a decrease in the yield. Disinfection of seed will, to a certain extent, control disease germs which are spread by infected seed, e.g., those causing footrot in the plants or discoloured patches on the leaves. It must be stressed, however, that the germs of the various diseases of cereals do not all occur externally on the grains. In the case, for instance, of loose smut of wheat and loose smut of barley, infection occurs in the flowering stage of the wheat and barley plants, with the result that the germ is contained inside the seed, where it is beyond reach of the solution or powder used for the external disinfection of the seed.

Disinfectants.

The disinfectants best known to the farmer are formalin and copper carbonate dust. The former is unprocurable at present, and its use will, therefore, not be discussed here. Copper carbonate is one of the older disinfectants and can be very effective against stinking smut in wheat if the percentage of copper contained in the preparation is high enough. Limewater is another preparation in which many farmers have faith, but it is the least effective of all the disinfectants now available and is, therefore, not to be recommended, especially in the case of diseases other than smut in cereals.

Disinfectants to be recommended for the disinfecting of seed against disease in general are the organic mercury compounds, e.g., Agrosan G or Ceresan. They are the most effective preparations known to us to-day, easy to apply, still available in South Africa in adequate quantities, and comparatively inexpensive. The prices at which organic mercury compounds were offered to farmers during the past year were as follows: Agrosan at 4s. 6d. per lb. or 26s. for seven lb.; and Ceresan at 7s. 6d. for two lb. or 35s. for ten lb. Quantities of 28 lb. and more were offered at even lower prices per lb.

Both these fungicides are applied in powder form, i.e., the seed is treated dry or dusted with the powder. Unless these fungicides are applied in excessive quantities or the treatment takes place several months before sowing time, the germinating power of the seed will not be damaged. Nor will the sowing of dusted seed in dry soil have any detrimental effect. In order to obtain the best results, the seed should be dusted very thoroughly. It is necessary, therefore, to place the seed, together with the requisite quantity of powder as indicated on the containers, in a churn or drum with a tight-fitting lid, revolving round a spindle, and to turn this slowly for 3 to 5 minutes. The seed and powder can also be mixed with a shovel on a cement floor. It is, however, much more difficult to obtain a thorough dusting of each grain in this way, and it is, consequently, less effective than mixing the seed and powder in a drum. Since

these organic mercury compounds are deadly poisons, the necessary precautions must be taken to ensure that none of it is taken in through the nose or mouth, and that no disinfected grain is fed to animals.

Loose Smut of Wheat and Barley.

Loose smut of wheat and barley can be combated only by means of the so-called hot-water method. The application of this method is much more difficult than dusting the seed with a powder as in the case of stinking smut of wheat, for instance, and unless special equipment is available, only small quantities of seed can be treated at a time. The process also requires very careful observation and precise handling, since, if the instructions are not carried out thoroughly, the treatment will either be ineffective or will damage the germinative power of the seed.

The method is as follows: First prepare the equipment, which consists of three tubs, one or more receptacles containing cold water, a pot of boiling water, a number of bags made of material suitable for rapid draining of water and a reliable thermometer.

Before the actual treatment is commenced, the bags are approximately half-filled with seed, and their open ends tied tightly, one end of the string being tied round one of the lower ears of the bag to facilitate immersion of the bag in hot water. Be careful not to make the bags too full, so as to allow the seed sufficient space for swelling. Since the seed absorbs a great deal of water and thus increases in weight, it is advisable to weigh it prior to the treatment so as to be able to determine the correct rate of seeding. Before being plunged into hot water, the bags are immersed in cold water in which they must be left lying flat for about 4 to 5 hours to soak. After the lapse of approximately half the time, the bags should be shifted to prevent the seed from caking. The first tub is then filled to two-thirds of its capacity with water at 120° F., the second tub is filled with hot water at 129° F., and the third with cold water. After the seed has been allowed to soak for the prescribed time, the bags are removed from the cold water, and then, after superfluous water has drained off, are plunged into the first tub of hot water by taking hold of the string tied to the side. The seed is left submerged in the hot water for approximately one minute, the bag being moved about constantly to ensure uniform heating of the seed. Thereupon the bag is lifted out and, after the water has drained off, is plunged into the tub containing hot water at 129° F. Here again the seed must be kept in constant movement, this time for a period of 10 minutes. During this time, however, the temperature of 129° F. should be strictly maintained. If it falls, just sufficient boiling water should be added to make it rise to 129° F. again. After the lapse of exactly 10 minutes, the bag is lifted out and immediately plunged into the tub of cold water. It is necessary to cool off the seed in this way in order to prevent damage which may be caused by keeping the seed at such a high temperature for a greater length of time.

Seed treated in this way should then be sown on a small piece of ground, to which no germs from infected grain lands can be blown by prevailing winds. The seed collected from this plot should be free from loose smut and can be used for planting purposes during the following season.

The Control of Deficiency Diseases in Plants.

Dr. B. J. Dippenaar, Department of Plant Pathology, Stellenbosch-Elsenburg College of Agriculture.

PRACTICALLY every farmer tries, as far as possible, to provide his fruit trees, winter cereal and vegetable crops with the three basic nutrients, viz., nitrogen, potash and phosphate. The great majority of farmers however, are, unaware of the fact that the so-called trace elements such as zinc, manganese, iron, copper, boron, magnesium, etc., are also necessary, even though in barely measur-

Fig. 1.—The leading shoots of a young Ohenimuri apple tree affected by a zinc deficiency and showing signs of little leaf at the tips. The other buds on some shoots failed to grow.

able quantities, for normal growth and formation of fruit or seed in plants. On various types of plants, symptoms have been observed which can be ascribed to deficiences of one or another of all these trace elements. These deficiencies sometimes give rise to very serious diseases such as little leaf in fruit trees, mottle leaf in vegetables and other crops and chlorosis plus a crop failure every other year in mandarin trees, the latter being caused by a magnesium deficiency.

Only very brief descriptions of the symptoms caused by a deficiency of the elements zinc and manganese can be given here, in the hope that growers will thereby be enabled to distinguish between these two diseases and apply the necessary control measures.

Zinc-Deficiency Diseases.

Up to the present in the western Cape Province zinc deficiency has been discovered only in fruit trees, in which it gives rise to the symptoms known as little leaf, especially in plum, peach and apple trees. It is, however, not unknown in pear, apricot and citrus trees. As the name indicates, one of the symptoms is the small size of the leaves (see Fig. 1). The leaves at the tips of the leading shoots are the ones mainly affected. These small leaves also lose colour until

they are pale-yellow or white. Affected shoots sprout and grow with less vigour each succeeding year and sooner or later they die back until they have to be removed during pruning. The result is that the tree grows smaller year by year. New shoots with more or less normal leaves always appear lower down but sooner or later they also die back. In addition, affected trees also lose their leaves sooner in autumn than healthy trees.

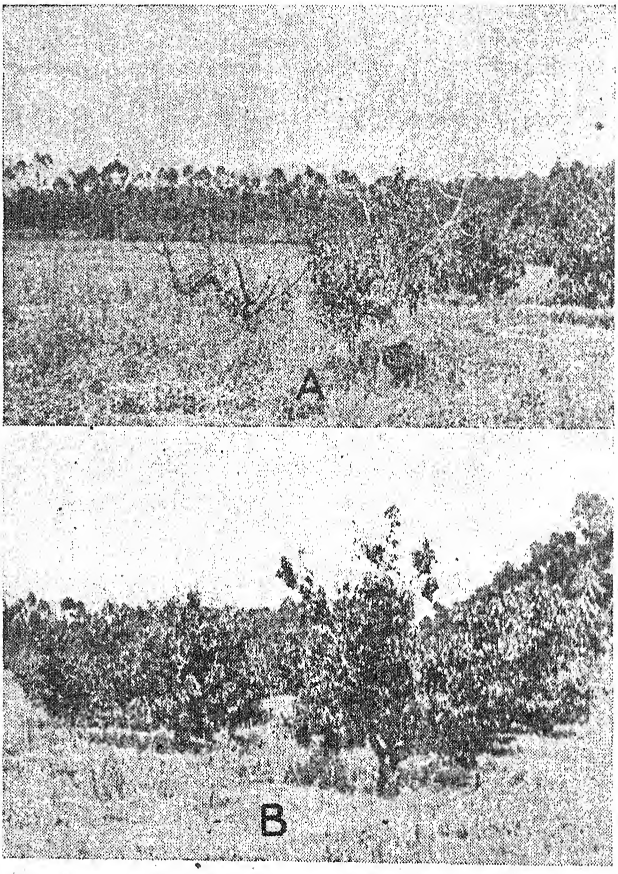


Fig. 2A.—The three trees on the left were not sprayed during 1938 and 1939, while the trees on the far right were sprayed during the early summer of both these years with 10 lb. zinc sulphate plus 5 lb. slaked lime per 100 gallons water. The unsprayed trees are practically without leaves. (Photograph taken 13/3/40).

Fig. 2B.—The same three trees as on the right in 2A. They are three trees from a plot of 16 sprayed trees. On 18 April 1940, i.e., more than a month after this photo was taken, the sprayed trees still had nearly 50 per cent. of their leaves.

Another symptom, e.g., in severely affected peach trees, is that apparently normal leaves situated lower down show a yellowing of their tissue between the veins, before the end of the growing season. This is called mottle leaf and is very common in citrus trees in which little leaf, again, is more the exception than the rule.

Without danger of contradiction, it may be stated that this disease causes the loss of more fruit trees in the winter rainfall area

than any other disease, fungus and bacterial diseases included. In addition, it attacks a greater variety of fruit trees (e.g., kernel, stone and citrus fruits) than any other widely known disease.

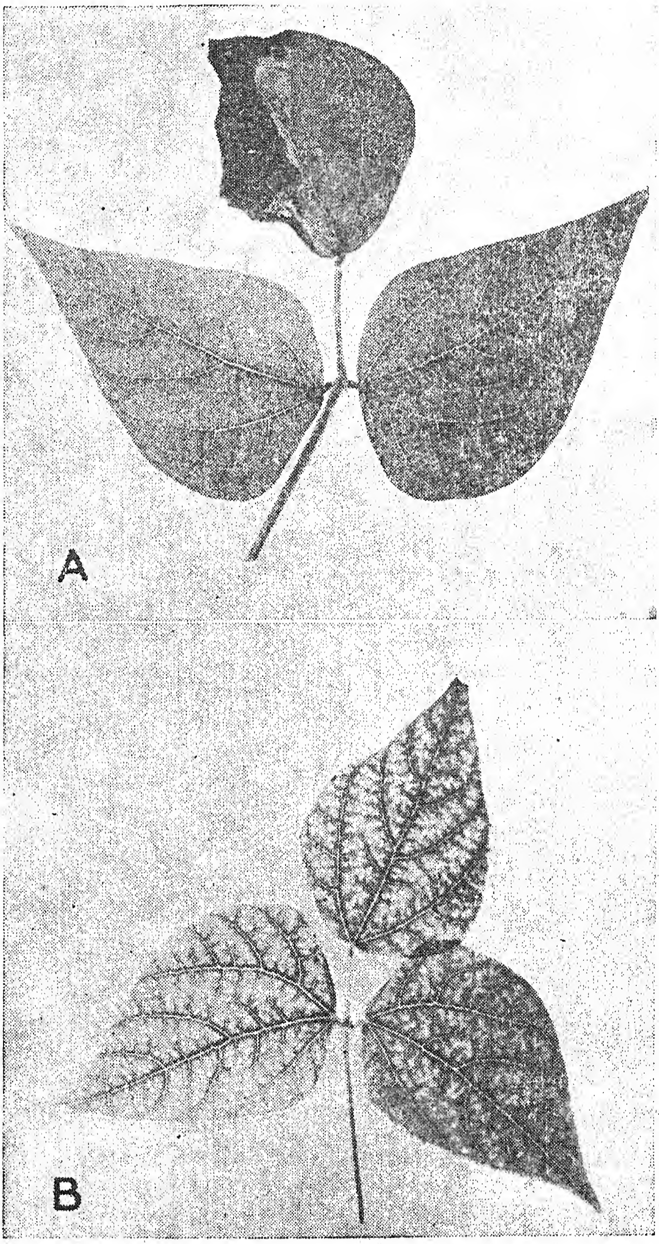


Fig. 3.—Mottle leaf (manganese deficiency) in bean leaves: (A) The leaf on the left was dipped in a ½ per cent. solution of potassium permanganate after it had shown clear and equally severe signs of deficiency as the leaf on the right. The centre leaf was scalded where large drops adhered to the tip. This photo was taken one month after treatment.

(B) This leaf shows different degrees of mottle leaf. The tissue around the veins is still green while the tissue in the small leaf in B, left, has lost its colour and has become nearly white.

A zinc deficiency in fruit trees may be due to either one or both of two causes, viz., an actual deficiency of zinc in the soil so that there is not enough for the plant's needs or an indirect deficiency caused by excessive applications of lime, which makes the zinc present in the soil inaccessible to plants. More than one productive orchard has been ruined by an injudicious application of lime.

Trees growing on poor or sandy and arid soils are more subject to the disease than those growing on fertile soil.

Control measures.—Fruit growers must in the first instance exercise the greatest care when applying lime. There is always the danger of little leaf. During normal times, when ammonium sulphate is available, the application of this form of nitrogen will, in the course of years, tend to increase the acidity of the soil, especially the sandy types, thereby making the zinc present in the soil more readily accessible to the trees (Figures A and B).

Affected trees react very well to sprays containing zinc (Figs. 2A and B). Judging from the results of our spray tests, it can be recommended that peach, apricot, pear and apple trees be sprayed during spring or early summer, i.e., as soon as they are in full leaf. That means that in the western Cape Province peaches and pears should be sprayed in October and November and apples in December. Winter-spraying of the above-mentioned varieties was less effective than summer-spraying but more effective than spring or summer spraying in the case of plum trees. Citrus trees are also sprayed during spring as soon as they show new growth but before the blossoms open.

For winter spraying of plum trees, from 20 to 50 lb. zinc sulphate per 100 gallons of water is used. Lime *must* be added for spring spraying in order to prevent leaf-burn; the following formula is recommended: 10 lb. zinc sulphate and 5 lb. best quality slaked lime per 100 gallons of water for peach, apricot and citrus trees; 15 lb. zinc sulphate and 7½ lb. lime for apples and pears. In dry weather, there is no danger of leaf-burn where these mixtures are used.

It may also be mentioned here that one application of this zinc-lime mixture on apple trees is an excellent preventative against leaf spot and marginal leaf-scald caused by arsenate of lead.

Manganese deficiency Diseases.

Mottle leaf is the name generally given to the disease symptoms appearing in plants which experience a manganese deficiency. In this case, too, a yellowing of the leaf between the veins takes place. The leaf tissues around the veins retain their green colour for a very long time (Fig. 3B). In plants like beans, potatoes, and chestnut trees, the yellow discoloured portions of the leaves may later develop necrotic spots in their centres, or the margins of the leaves may become severely scorched under warm, dry conditions. These phenomena apparently do not occur in the case of citrus trees. Leader shoots of severely affected citrus trees die back but without the development of any symptoms of little leaf. Of interest, especially to fruit growers, is the fact that peach trees, e.g., those showing symptoms of severe manganese deficiency, bear very poorly.

In the western Cape Province manganese deficiency in plants is of even more general occurrence than zinc deficiency, affecting a large number of vegetable varieties as well as fruit trees and ornamental plants such as Bougainvillea, roses, etc. Sometimes a plant shows symptoms of both zinc and manganese deficiency. Peach and citrus trees have been affected in this way, and in such cases it is necessary

to treat the tree against both deficiencies before complete recovery can be expected.

The factors which cause a zinc deficiency in plants are the same as those which bring about a manganese deficiency.

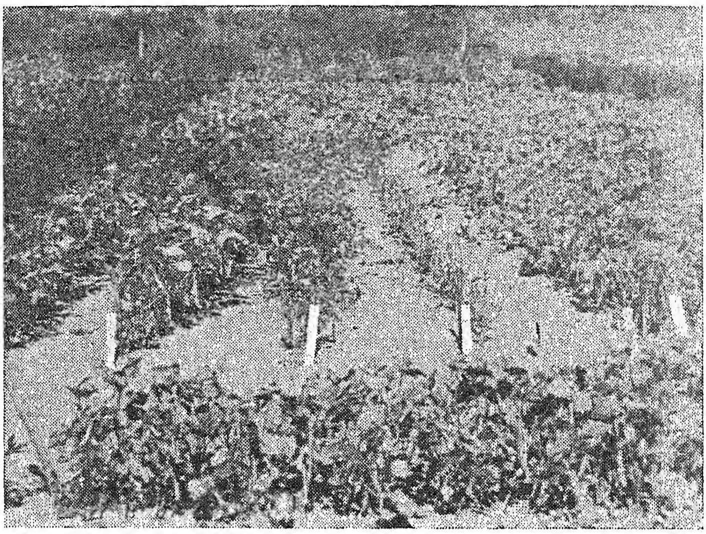


Fig. 4.—Canadian Wonder beans sprayed with manganese sulphate, from left to right: 1st peg, manganese sulphate, ½ per cent. three times; 3rd peg, not sprayed, only fertilizer to the soil, 4th peg on far right, stable manure.

Control measures against manganese deficiency have been tested out very thoroughly on fruit trees in the western Cape Province on vegetable crops and ornamental plants. The following treatments can be recommended:—

Peach, apricot, plum, apple and citrus trees must be sprayed with a ¾ per cent. solution, i.e., 2½ lb. commercial manganese sulphate per 100 gallons of water, as soon as they are in full leaf and begin to show symptoms of the disease. In the case of severely affected plum trees it may be necessary to spray a second time about 4 to 6 weeks later. Peach trees which bear poorly as a result of manganese deficiency, must be given an extra winter spraying about 6 to 8 weeks before they start blossoming. In this case a solution of 10 to 15 lb. of manganese sulphate per 100 gallons of water is used. In our test plots, this treatment resulted in a tremendous increase in the peach crop.

The same solution, viz., 2½ lb. manganese sulphate per 100 gallons of water, is used for vegetable crops, e.g., beans and potatoes. Two or three sprayings are given at intervals of from 14 days to 3 weeks. A glance at Fig. 4 and Tables 1 and 2 should be sufficient to convince the reader of the salutary effect of such treatment.

Manganese sulphate may also be applied to the soil, but in soil with a high lime content, the major portion of the manganese sulphate applied will be precipitated, thereby becoming inaccessible to the plants. Although spraying the plants involves much more time and labour than broadcasting the manganese sulphate on the soil the cost of the material is much less than in the latter method.

TABLE 1. *Results from potato crops sprayed with manganese suplhate and pyrolusite (finely ground manganese ore).*

Treatment.	Number of seed potatoes.	Weight of seed potatoes.	Weight of foliage.
		lb.	lb.
No treatment........................	820	21·25	84
Sprayed twice with ¾ per cent. manganese sulphate..........................	2628	115·75	184
Sprayed twice with ½ per cent. pyrolusite	2404	88·75	148

TABLE 2.—*Results from beans sprayed with manganese sulphate.*

Treatment.	Total weight of dry beans.	Seeds abnormal in form and colour.
	Gram.	Per cent.
No treatment..............................	1939·5	37·8
Manganese sulphate to soil 200 lb. per morgen....	5161·0	17·0
Pyrolusite to soil 400 lb. per morgen...........	3829·0	24·7
Sprayed three times with ¼ per cent. manganese sulphate................................	7184·5	11·0
Sprayed three times with ¼ per cent. pyrolusite..	3561·0	16·5

If sufficient stable manure is applied to vegetable soils showing symptoms of such a deficiency, the results obtained will be as good as or perhaps better than those obtained where only fertilizers are applied and the plants later sprayed with manganese.

Seed beans or potato tubers grown on soil with a manganese deficiency, will, even if planted in normal, fertile soil, produce plants showing a greater or smaller degree of manganese deficiency. This can be prevented in beans by soaking the seed in a ¼ per cent. manganese solution for 4 to 6 hours immediately before planting. Soaking the seed for a longer period will be injurious.

In cases where both a manganese and a zinc deficiency was determined in orchard trees, such as citrus and peach trees, the deficiency symptoms were removed by spraying the trees with a spray consisting of 10 lb. zinc sulphate, 5 lb. manganese sulphate and 7½ lb. good quality slaked lime per 100 gallons of water. The results of these tests further showed very clearly that a zinc-lime mixture, as recommended for early summer spraying, is an excellent remedy against leaf rust in apricot and peach trees, but that a manganese-lime mixture is wholly ineffective. In mandarin trees, however, it was found that the zinc-lime mixture or the zinc-manganese-lime mixture is not nearly as effective as Bordeaux mixture against leaf or fruit spot caused by the *Macrosporium* fungus.

The foregoing will enable fruit growers to decide which spray to use in cases where two or even more diseases attack the same type of fruit tree or crop.

Nursery Quarantines.

The following nursery quarantine was in force on February, 1943:—Page's Nurseries, Goede Rust, Franschhoek, for red scale on citrus trees.

Fertilizing Vegetables in the Winter-Rainfall Area.

I. S. Perold, Professional Officer (Agricultural Chemistry),
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SINCE 1939 the cultivation of vegetables in the winter-rainfall area has been considerably increased. This is doubtless a step in the right direction but time has shown that many farmers do not get the desired results because the wrong type of fertilizer is used. In fertilizing vegetables, special attention must be paid to the type of soil, the vegetable variety that is cultivated and the amount and type of water available for irrigation purposes.

Fertilizers Required.

Fertilizers play a very important rôle in the cultivation of vegetables, but they must always be used together with organic material the best-known of which, available to farmers at present, are stable manure, compost and Karroo manure.

Stable Manure.—Well cured stable manure is an excellent source of plant nutrients, and since the supply is very small, farmers must now, more than ever before, make the best use of it. Stable manure must not be allowed to dry out and must, if possible, be carted out on cool days.

Another important point in the application of stable manure is that it must never be dumped in heaps on the lands and left for weeks or even months before being used. Such a procedure will result in the loss of much of the nitrogen and the growth of mould in the manure. The nitrogen in such moulds is extremely inaccessible to plants since it occurs in the form of mildew or fungoid proteins.

*Compost.**—Compost consists of vegetable waste material which has been broken up into a very easily accessible organic fertilizer with the aid of small quantities of animal manure and/or night soil. This fertilizer is very similar to well cured farm manure and is used in the same way. It is the duty of every farmer to make as much compost as possible on his own farm and it is hoped that all municipalities and town councils will respond to the appeal made to them by the Department of Agriculture and Forestry to make compost out of all waste products and night soil. At present, compost is in many instances the only source of organic fertilizer available to town and city dwellers and it is especially important that such people should pay due attention to the manufacture of compost from all vegetable waste such as cabbage, carrot, beetroot and turnip leaves as well as pea shells, potato peelings, weeds, leaves, etc.

Karroo manure.—Karroo manure can be used for the cultivation of vegetables, but on account of its high alkaline content it should be used only on sour soils which can be irrigated or which lie in a high-rainfall area.

Applications of Karroo manure must not exceed 4 to 5 tons per morgen. The manure must be broadcast and ploughed or dug under before the vegetables are planted, i.e., it must not be applied in the furrows.

An important hint in connection with the use of Karroo manure is that it must in no circumstances, even with ample irrigation, be used for the cultivation of potatoes since it causes, almost without exception, the development of a physiological scab on the tubers.

* See *Farming in South Africa*, September 1942.

Fertilizers.

Since fertilizer mixtures have been standardized it seems that many farmers are not clear about the composition of the different mixtures. These mixtures are composed of the three essential nutritive materials nitrogen, phosphate and potash in different ratios and it is, therefore, essential to group all vegetables according to their requirements in regard to these basic nutrients.

Crops grown for their leaves usually require most nitrogen. The most important vegetables in this class are cauliflower, cabbage, celery, lettuce, cabbage lettuce, spinach, etc. A mixture with a high nitrogen content but with sufficient potash and phosphate, must, therefore, be used for this group. In the winter-rainfall area with its relatively high rainfall and exhausted soil, *mixture G* should be used. together with kraal manure and compost.

Most soils in South Africa suffer from a phosphate deficiency and this is especially the case in the winter-rainfall area. Phosphate must, therefore, be applied to all soils and types of vegetables, especially those grown for their fruit, such as tomatoes, peas, beans, watermelon, sweet melon, etc.

For this group, *mixture C* plus stable manure and compost may be used on fertile soil; but on poorer soil better results will be obtained with *mixture F* plus manure.

The last group of vegetables, viz., those requiring much potash, consist of potatoes, sweet potatoes, onions, beetroot, all root crops, etc. In this case *mixture F* is also recommended, plus manure or compost.

The following should serve as a general guide regarding the actual quantities of fertilizer which should be applied:—

Fertilizing leaf crops: 800 to 1,200 lb. of *mixture G* plus 20 tons of manure or compost per morgen.

Fertilizing tomatoes, beans, peas, etc.: From 800 to 1,000 lb. of *mixture C.* plus 15 to 20 tons of manure or compost per morgen can be applied to fertile soil, but poor soil such as is found on the Cape Flats, requires 800 to 1,200 lb. of *mixture F* plus 20 to 25 tons of manure or compost per morgen.

Fertilizing bulb and root plants: From 800 to 1,200 lb. of *mixture F* plus 20 to 30 tons of manure or compost per morgen.

The best results are usually obtained if the manure or fertilizer is applied in the planting furrow, especially when supplies of fertilizer are limited. The exception, however, is Karroo manure, which must never be applied in this way.

Less Well-known Plant Nutrients.

During the past two or three years, tests have been carried out in the winter-rainfall area with less well-known plant nutrients such as manganese, copper, boron, etc., and considerable increases in crop yields have been obtained on certain soil types by the application of from 20 to 30 lb. manganese sulphate per morgen in addition to the usual fertilizers. On the Cape Flats it was also found that most vegetable types react positively to sprayings with diluted watery solutions of manganese sulphate. In the sandy lime soil along the south coast a serious copper deficiency was discovered, and although tests have thus far been carried out only with winter cereals, there seems to be every reason to believe that applications of minute quantities of copper sulphate (blue vitriol) will also benefit crops like vegetables. It may be added here that one of the great advantages attached to kraal manure and good compost is the fact that they

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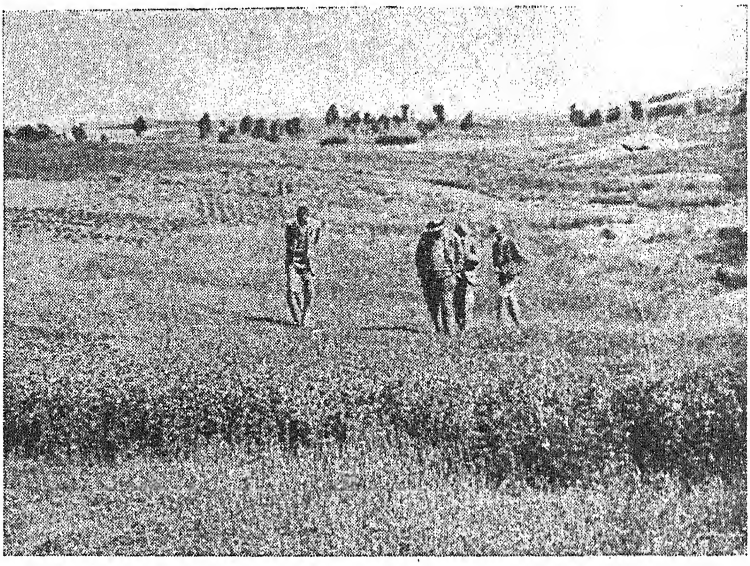
Clovers for the Winter Rainfall Area.

Dr. P. W. Vorster, Department of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

CLOVER and lucerne both belong to the legume family. Not only do they provide a very valuable pasture with a high protein content but they also have a very beneficial influence on the fertility of the soil. Clovers require no nitrogenous fertilizer but actually provide the soil with nitrogen and thus increase the fertility of impoverished soil. In the case of mixed pastures, clovers also have a beneficial effect on the grass since they also provide the grass with



Clover varieties in the foreground. Co-operative experiment in the Caledon District.

nitrogen which not only enables it to grow more luxuriantly but makes it more palatable and nourishing.

Climatic and Soil Requirements.

On the whole, clovers grow best in those areas where the climatic conditions are cool and moist throughout the year, but do not thrive so well in dry, hot areas. Experiments with clover at the Langgewens Experiment Station showed that the rainfall is too low in the Swartland area and also that the summers are too dry and hot for any of the clover varieties to be cultivated with success. Experiments in the districts of Caledon and Bredasdorp, where the summers are not so dry and hot, showed that most clover varieties grow reasonably well in that area.

Most clovers also require sweet soils although some varieties can be grown on soil which is too sour for lucerne. If the soil is very sour, it should first receive the required application of lime before the clover is sown. Since clover seed is so fine, it is absolutely essential that the soil should be prepared as thoroughly as possible. The seed should be covered very lightly. This can be done with the aid of a light, blunt tined harrow, a chain or even a branch. Sometimes the seed need only be rolled in.

It is also important that the clover seed should be inoculated with the required nodule-forming bacteria if clover has not previously been cultivated on the soil. The necessary inoculum or bacterial cultures for clover can be obtained from most seed merchants.

Suitable Varieties.

The great problem in connection with clover to-day is the difficulty in obtaining seed since most of it was imported from oversea.

Subterranean Clover. (*Trifolium subterraneum*).—This variety has recently become very popular in this area, especially in the Caledon, Bredasdorp and south-western districts. It is an annual which emerges after the first autumn or winter rains and grows luxuriantly during winter and spring, running to seed at the end of spring. After that it becomes dry. As soon as the flowers die, the tips of the seed-stems turn down and the seed capsules bore into the ground so that the plant provides covering for its own seed, hence the typifying name—subterranean clover. The plant, therefore, also assumes the characteristics of a perennial.

This variety is able to stand a fair amount of cold so that good results are obtained even in the Koue-Bokkeveld (Ceres district). It is, however, very sensitive to dry, hot weather. If drought is experienced during early spring, the plants soon become parched. The moister and cooler climatic conditions are during spring, the longer will the clover remain green. It provides green grazing up to the end of December in the Koue-Bokkeveld but at Elsenburg it begins to dry up as early as October.

Subterranean clover provides valuable protein-rich grazing during winter and spring. It has a prostrate growing habit and is able to cover the soil completely with a dense mat. Where this clover grows very luxuriantly, it can be cut for hay at the beginning of spring and the aftergrowth used for grazing. Care must be taken, however, that it is not grazed so severely that sufficient seed cannot be formed for the next season's crop. During summer the dry leaves and stems provide very valuable and nutritive grazing for sheep. To all intents and purposes subterranean clover, therefore, provides its own hay for the summer.

There are three different types of subterranean clover, viz., early, mid-season and late varieties. Dwalganup is the best-known early variety. On the whole, the mid-season varieties (Mount Barker, Bacchus March, etc,), appear to give the best results in this area.

Subterranean clover has no special preference for any particular type of soil. It does well on soil on which lucerne will not grow, e.g., poor, sandy soil or on soil which becomes too wet during winter or on soil which is too acid for lucerne. Subterranean clover also gives good results on soils in the Riversdale district where lucerne will not grow well for some reason or other. Subterranean clover can also be sown in mixed pastures together with Phalaris tuberosa, rye grass or even Rhodes grass.

The best time for sowing this clover is during autumn at the rate of about 10 lb. per morgen on well prepared soil. It is a crop that reacts well to phosphate fertilizer and about 400 lb. super phosphate per morgen should be applied to the soil before planting.*

* For further particulars see: "Subterranean Clover" by N. L. Smit, *Farming in South Africa*, May, 1941, and reprint No. 42.

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Mash in Poultry Feeding.

C. L. Liebenberg, Head of the Department of Poultry Husbandry, Stellenbosch-Elsenburg College of Agriculture.

SINCE poultry feed has now virtually become one of the limiting factors in the expansion or commencement of poultry farming, special attention should be given to the most economical and effective use of the available feeds. Hundreds of thousands of chicks have been hatched during the past season and an enormous wastage of feed is taking place in the chicken runs. Breeders should note the following aspects of chicken feeding, not only in their own interests but in the interest of the industry as a whole:—

(a) *The composition of the feeds.*—It is essential that from the very first day a chick should be fed a properly constituted ration consisting of an easily digestible mash in order to ensure maximum development. It is a waste of valuable time and energy and an uneconomic policy to feed chicks during the first two weeks on a crushed grain alone (mostly maize), and to commence with a mash only after the third week. A maximum gain in weight is obtained only when the chick's body is supplied from the very first day with the necessary proteins, minerals, vitamins, etc., which are not found in crushed maize alone.

(b) *Types of mash hoppers.*—The greatest actual wastage of feed occurs as a result of unsuitable types of mash hoppers being used. In most chicken runs a thick layer of mash will be found underneath the litter. This mash has simply been scratched out by the chicks, and when the chicken run is cleaned all this useful feed is lost together with the litter. Too many types of open mash hoppers in which the chickens can scratch and soil themselves to their hearts' content are still found in our otherwise modern chicken runs. Suitable types of mash hoppers which can be made at very small cost exist to-day, and plans, sketches and measurements are obtainable gratis on application from any College of Agriculture.

(c) *Size of mash hoppers.*—Too often do we find, especially at the present time when prices are high, that the size of the mash hopper is altogether out of proportion to the size of the group of chickens served by such a hopper. The result is that the chickens trample each other and the weak ones suffer. Two hoppers, each two feet long, are necessary for every 100 chickens up to the age of 4 weeks. Sufficient water and enough hoppers should be provided in order to ensure comfort and the proper development of the chickens.

(d) *Mash hoppers and laying hens*:—Note the following:—

(i) Mash hoppers are often too small. Labour can be saved by providing runs with hoppers which need filling only once a week.

(ii) Hoppers should be protected against strong prevailing winds and rain if left out of doors. Too much valuable food is blown away or becomes mouldy and sour as a result of exposure to the rain.

(iii) Open hoppers are totally unsuitable and uneconomical in every respect. Plans of mash hoppers are obtainable on request from any College of Agriculture.

(iv) Feeds are scarce and form the main item every month on the farmer's expenditure list.

(v) The composition of the feed has a direct effect on the production and health of the hen.

Clovers for the Winter Rainfall Area:—

[Continued from page 198.

Wild White Clover (*Trifolium repens*).—Of the other clover varieties, white clover is perhaps the best-known and most important in this area. There are various types of this clover such as English, New Zealand and Dutch white clover and they grow best on low-lying damp soils which remain moist for a long time. It is usually sown on such soil together with other grasses such as rye grass, Phalaris tuberosa, paspalum, Rhodes grass, etc. In such a mixed pasture it can stand very heavy grazing. It should be sown during autumn at the rate of 5-8 lb. per morgen.

Other Clover Varieties.—There are various other varieties such as Red Clover (*T. pratense*). Alsike (*T. hybridum*), Crimson (*T. incarnatum*), Yellow Trefoil (*Medicoga lupulina*), etc., which grow fairly well in the Caledon-Bredasdorp area and in the south-western districts but it is doubtful whether any one of them will be able to replace lucerne, subterranean clover or white clover.

Rhodes Grass as a Pasture Crop:—

[Continued from page 186.

safest time for sowing is during September and October when the seed can be sown on dry land and left to germinate after the first rains. The seed is sown at the rate of 15 to 20 lb. per morgen. As the seed is so fine and light, it must be mixed with fertilizer or fine Karroo manure and sown through the fertilizer hopper of the sowing machine. The seed must be stirred continuously in order to ensure a good flow. Since the seed must be sown very shallow, the spouts should be removed or disconnected at the discs which must cut the soil very lightly or not at all.

The required rate of seeding of the machine must be determined in order to get the correct flow of seed and fertilizer. This can be done as follows:— 200 lb. of fertilizer is mixed with 20 lb. Rhodes grass seed. The mixture is placed in the fertilizer hopper and the seeding rate determined as described elsewhere in this issue.

After the seed has been sown, the land should again be harrowed and then rolled, preferably with a corrugated roller. These final cultural treatments are of the utmost importance and are usually the decisive factor in the successful cultivation of Rhodes grass.

Fertilizing Vegetables in the Winter Rainfall Area:—

[Continued from page 196.

usually contain adequate quantities of these less well-known, although important, plant nutrients.

On all sandy soils with a high rainfall or where irrigation is possible, it is advisable not to apply all the fertilizer at planting time, but to reserve one-quarter to one-third for application after the plants have been well established. This is essential in the case of such crops as potatoes, tomatoes and the cabbage varieties. In the case of potatoes this late application of fertilizer is applied in the rows during ridging. In the case of tomatoes it is applied as soon as the first flowers appear and for most other crops from 6 to 7 weeks after planting. Government guano, ammonium sulphate or Chile saltpetre, if available, should preferably be used as top dressing.

Dryland Lucerne.

Dr. J. T. R. Sim, Professor of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

FORMERLY it was generally accepted that lucerne production in the winter-rainfall area was possible only in the irrigation regions, but during the past fifteen years investigations have revealed that lucerne can also be grown very successfully as a dryland crop almost throughout the entire winter-rainfall area. The total yield is naturally much lower than that of lucerne under irrigation, but

FIG. I.—A good stand of dryland lucerne.

its value in supplying green feed during difficult times can hardly be over-estimated.

Once established, dryland lucerne provides an abundance of excellent quality feed, allowing grazing at frequent intervals for approximately nine months of the year. It springs into active growth with the first autumn rains, and supplies nutritious grazing early in the autumn when green feed is urgently needed, and at a time when dairy products are high in price, and when succulent feed is essential during the lambing season.

Provided the soil is not sour, the dryland lucerne continues to grow fairly strongly throughout the winter months, for the temperature is seldom so low as to affect the growth seriously. With the warmer conditions of spring it produces luxuriant growth, so that, with other green feed plentiful at this time, it is frequently possible to allow the crop to flower and then to cut it for silage or hay. Thereafter the crop continues to supply valuable grazing well into December, and sometimes into January. Normally, however, conditions are so dry in January, February and March that the crop fails to produce grazing of any value. Occassionally sporadic summer showers may liven up the crop so that it provides unexpected grazing for short periods in the summer, but such grazing is the exception and should in no wise be relied upon.

Requirements of the Crop.

Reaction of the Soil.—While dryland lucerne is very hardy it is nevertheless very sensitive to soil acidity. Many of the failures which have occurred may be traced to the soil having been too sour —a condition which could have been corrected by a dressing of agricultural lime. Most soils in the grain-producing areas, being sufficiently sweet, require no lime, but in the higher rainfall districts and especially along the mountains the soils often require liming for the production of good dryland lucerne.

It has been found that the degree of acidity of the soil or the pH, as it is called, should be between 6.0 and 7.0, if dryland lucerne is to succeed. Before sowing, the farmer should submit a sample of his soil to the Agricultural College for testing its acidity. If the pH value is unduly low, he will be advised how much agricultural lime he should apply to the land. Seeing that this procedure (which entails only a nominal fee of 2s. 6d. for a test) may mean the difference between failure and success, it should be a matter of routine. The application of one or two bags of lime per morgen has normally no evident effect, and the quantity to be added to acid soils is usually from one to three tons per morgen. Although this may at first appear startling, it must be realized that the price of agricultural lime, as well as the transport tariff, is so low that the expense of liming is not great, and it is more than compensated by the success of the crop.

Lucerne is likewise not a brack-loving crop, but on slightly brackish soils the crop usually grows well once a stand is obtained. Under such conditions, germination is the most critical phase.

Weeds.—The first aim in growing dryland lucerne is to get a good stand, and apart from the preparation of a good seedbed, weeds have to be brought under control before sowing. Kweek (*Cynodon dactylon*) is the worst enemy of dryland lucerne, but koperdraad- or Litjiesgras (*Polygonum aviculare*), steenboksuring (*Rumex acetosella*) and duwweltjies (*Emex australis*) can also do much harm. These weeds, particularly kweek, can so damage the stand that already in its second year the lucerne is a failure. Very many crop failures and poor stands are attributable to this cause. The first essential therefore is to choose lands free of kweek and its associates or else to prepare the land sufficiently well so that the weeds are exterminated prior to sowing.

Preparation of the Seedbed.

The usual procedure in preparing the seedbed for dryland lucerne is to braak the soil well in July—August and to fallow it for a year. If lime is to be added it should be brought in at braaking time. In the spring the land should be deeply cultivated with a heavy tine cultivator, and during the summer it may further be cultivated after rains, with the object of killing weeds. If the land contains kweek or steenboksuring it must be ploughed and cultivated several times during the summer when the soil is dry in order to destroy them.

The following April the soil should be ploughed, and if manure is available it should be brought in with this ploughing at the rate of 10-20 tons per morgen, together with a basic dressing of superphosphate at the rate of 800 lb. per morgen. If manure is not available then *mixture E* should be ploughed in at the rate of 800 lb. per morgen. Pure superphosphate might also be sown, but *mixture*

E contains 4 per cent. nitrogen which will be very beneficial in giving the young lucerne a good start off.

Formerly it was recommended that in the higher rainfall districts a crop of barley should be sown at this time on the land, for grazing purposes. This practice has not proved a success, however, for with due provision being made to prepare the necessary fine seedbed for lucerne, the barley has to be ploughed in during July, and the grazing period of the barley is then too short to be worthwhile.

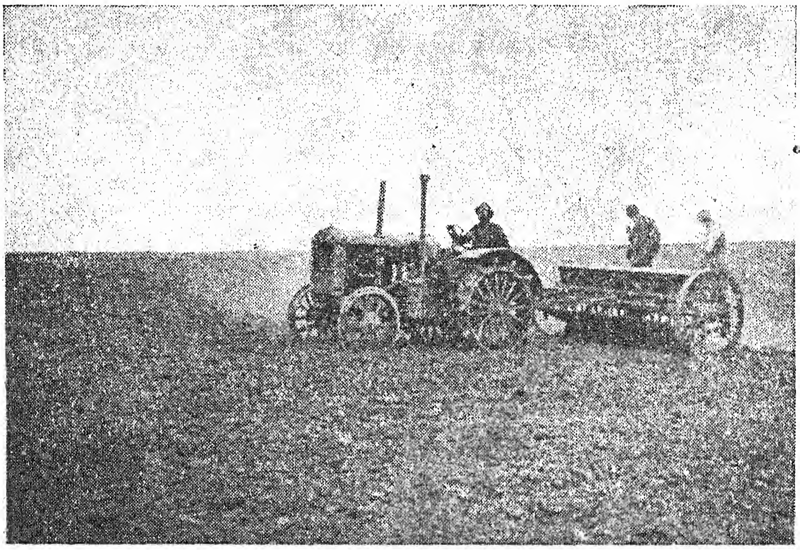

FIG. 2.—A quick and effective means of sowing dryland lucerne.

Under the drier conditions of the Swartland, the soil should be given its final seedbed preparation in July. If the soil is free of weeds it may be cultivated by means of a heavy tine cultivator, if weedy it must be shallow ploughed. In either case the soil must then be worked into a fine tilth. Cultivators, discs, harrows, rollers or combinations of these implements may be used for this purpose, according to soil conditions. When a good seedbed has been prepared, i.e. one which is fine, mellow and firm, the lucerne seed is sown. It is essential that a good seedbed must be prepared, for lucerne seed is small, and germinates badly on a poorly prepared seedbed.

In the higher rainfall districts a similar treatment is necessary to permit of sowing in August-September. Later sowings cannot be recommended, for the soil frequently becomes too dry in October.

Actually the best sowing time for dryland lucerne in the winter-rainfall area should be April-May, but sowing at this time can be done with success only if the soil is free of winter weeds, which would smother the young seedlings. But few soils indeed are so clean, and generally autumn sowing is so risky that the practice cannot be recommended. If sowing is done in autumn, it is best to sow in rows, so that cultivation for weed eradication can be done.

While the above is the standard method of preparing the soil for dryland lucerne, it has the disadvantage that the fallow year is a non-productive year. In the Caledon-Bredasdorp region, where dryland lucerne is rapidly extending, an alternative practice is

followed which is generally successful. In this system the young lucerne is grown together with wheat or oats on braakland. The braakland is well prepared and the grain and fertilizer drilled in. The land is then harrowed and the lucerne broadcast behind the harrow. The seed is covered with a final light harrowing. The two crops grow together and when the grain crop is harvested the lucerne crop continues its growth. By this method the farmer does not have to lose a year in special preparation of the land for the lucerne, and, should the lucerne crop fail, the cost of the failure is only the cost of the seed.

Although this method has succeeded in at least one case in the Swartland, too many failures have occurred to permit the method to be generally recommended for that area with our present limited knowledge.

Another method which has borne some success is that of ploughing over manured stubbleland in the autumn (April-May) and then working the soil into a fine seedbed for seeding to lucerne in July-August-September. The method requires of course, that the land so treated must be free of kweek and other weeds likely to smother the lucerne. This method appears to have promising possibilities but needs to be tested further before it can be generally recommended.

Variety and Seed Treatment.

Three varieties are well known and usually procurable, namely Provence, Hunters River, and Chinese. Under dryland conditions there is little to choose between Provence and Hunters River, but Chinese is generally slightly inferior to both. Since the price of Provence seed is normally lower than that of Hunters River, preference must naturally be given to Provence. Preference should further be given to good quality seed. Even when sown for grazing purposes, low-grade seed seldom gives satisfactory results.

If the lucerne is to grow well and fix nitrogen from the air into the soil, the plants have to be inoculated with the proper nitrogen fixing nodule bacteria. Where the lands to be sown grow burr clover there will be natural inoculum in the soil, for burr clover is inoculated with the same bacteria as lucerne. It is generally the safest, however, to inoculate all lucerne seed artificially before sowing. This can be done by means of purchased pure culture inoculum, but a very satisfactory method is to inoculate the seed in the following manner:—

Obtain a few pounds of moist soil from a field where lucerne has grown well and where it had nodules on its roots, but avoid the first inch of soil. Spread the lucerne seed out on a cement floor and moisten it by means of a watering can with a thin glue solution (½ lb. glue in 1 gallon water) until the seeds are all damp. Work the seed over with a spade. Then sieve the soil over the seed until all the exposed surfaces of the seeds become dirty with soil particles. Turn the seed over a few times with the spade and sieve on the soil again. Finally spread the seed out in the shade and allow it to dry. Each seed then carries some soil and some bacteria, and in this condition it is ready for sowing.

Seeding.

The customary rate of seeding for dryland lucerne is 40 lb. per morgen. In the higher rainfall districts and also in the Caledon-Bredasdorp region, the seed is normally broadcasted, either by hand or by broadcasting machines. In the Swartland, however, the crop

of a light worn-out harrow, or simply by dragging a harrow made of branches over the land.

gives much better results when sown in rows. Small areas may be sown by means of a bottle with a hole in the cork, in shallow furrows chopped with the spade. Where large areas must be sown, this method is too slow and expensive. The seed can be sown most effectively by means of the grain drill. The seed is mixed with fertilizer at the rate of 40 lb. of seed to 60-80 lb. of fertilizer and sown from the fertilizer box, in which certain of the seeding pipes are closed so as to give a spacing of 28 in. between

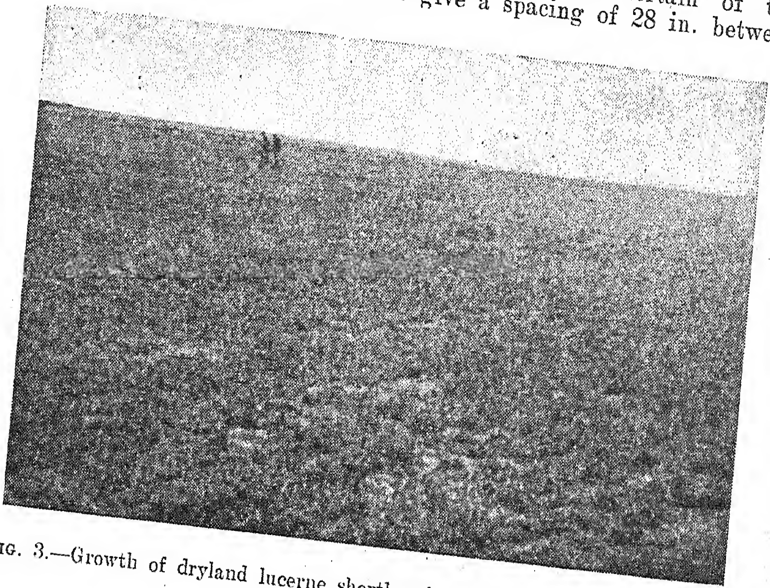

FIG. 3.—Growth of dryland lucerne shortly after being cut for hay, on sandy soil near Darling.

rows. This requires that three pipes must be closed for every one left open. Another useful setting is to have two pipes open and three pipes closed, thus giving seeding in double rows. The setting of the seed drill to give the correct rate of seeding must be tested before sowing.* This method of seeding is very efficient and also very rapid, as demonstrated by the fact that one twenty morgen camp at Langgewens Cereal Station was sown in this way in 8 hours.

Whatever method of seeding is followed, it is essential that the seed must be sown shallow. If the soil is at all loose it should be rolled to prevent the seed being sown too deeply. Rolling may be done either before or after seeding, but the latter appears to give the best result. If the seed is sown by means of a grain drill on a rather loose seedbed, the discs or hoes of the machine will be apt to sink too deeply into the soil, so bringing the seed in too deeply. This danger can be obviated either by allowing the pipes to hang loose behind the discs or hoes, so that the seed is sown on the surface, or by raising the discs or hoes by means of a pipe or bar placed under the disc or hoe arms and tied to the upper framework of the drill. After sowing, the seed may be rolled in, or lightly covered by means

* For testing rate of seeding see article by Dr. P. D. Henning, printed elsewhere in this number, "How to test the seeding rates of a grain drill".

Care of the Young Crop.

The success of the lucerne crop depends to a large extent upon the treatment given to the seedling crop. Only if the seedlings grow strongly should the young crop be grazed during the first six months of growth, and then the grazing should be very light. Heavy grazing will so weaken the crop that it will never fully recover. During January, February, March and April no stock should be allowed on the young lucerne. Pigs in particular must be excluded, as they can do much damage by rooting.

With the first autumn rains superphosphate at the rate of 200 lb. per morgen should be given as a topdressing and the land should be harrowed. The crop is still too young and weak at this stage to stand heavy cultivation. From the time when the new growth has developed strongly onwards, the pasture may be grazed at regular intervals.

It has been observed that on very sandy granitic soils the young crop sometimes comes away poorly. It has been found that a top dressing of 100 lb. of Government guano per morgen helps to ensure good growth.

In August when the pasture is short cropped the land is given another top dressing of 200 lb. superphosphate per morgen and is then well loosened with a heavy tine cultivator fitted with diamond points. This loosening is very necessary, for often the soil is so compacted by the animals grazing on a wet soil in the winter that the growth of the lucerne is retarded. Farmers may fear that this rough handling will damage the crop badly. Actually the reverse is true, for the lucerne thrives upon such treatment.

Such superphosphate topdressings and deep cultivation are given twice annually during the life of the crop, once each year in April-May, and once in August. An additional treatment which improves the winter grazing of the lucerne, is to sow oats or barley over the lucerne land prior to the April cultivation once the lucerne is two or three years old, at the rate of 40-60 lb. per morgen. Naturally only certain of the lucerne lands can be so treated, otherwise there will be a shortage of grazing in the critical autumn period, while the oats or barley and lucerne is developing to a grazing stage. The winter pasture then gives a greater bulk of feed and in addition supplies what the animals so enjoy, mixed grazing.

It frequently happens that caterpillars attack the lucerne crop in December. If this occurs it is best to turn the livestock into the lucerne in order to graze the crop down. It is claimed that rolling the crop helps in destroying the insects.

Grazing the Lucerne.

Lucerne established and treated as described above can give excellent grazing for all classes of livestock from May until the dry summer weather sets in. But this quality of grazing can not be obtained if the animals are just turned into the pasture and allowed to graze continuously, and indefinitely. When this is done the plants become weakened and fail to make satisfactory growth or to supply sufficient grazing. Disappointing results with dryland lucerne are often directly attributed to this cause.

Instead, the pasture should be grazed at periodic intervals. In other words, once the lucerne is grazed down the stock must be

removed to another camp, and the lucerne be given a chance to grow out again and to build up root reserves. Then it can be grazed down again and thereafter again rested. In this way the lucerne will give much greater yields of pasturage, and the life of the crop will be lengthened.

Light continuous grazing is also not desirable, for the animals then simply top the plants, and leave the stems to become woody and unpalatable. It is better to graze the crop right down in a shorter period and then to rest it while it grows out again.

So far as the sequence of grazing animals is concerned, milch cows and ewes with lambs should get preference, to be followed by heifers and dry cows, and the remainder of the crop can be cleaned up by sheep and draught animals.

Life of Dryland Lucerne.—The life of the crop will depend very largely upon the grazing treatment to which it is subjected. With light grazing it may last from 7 to 9 years, with heavy grazing from 4 to 5 years. If it is too heavily grazed in the first year, or if it is continuously grazed, its life will be markedly shortened.

It may be observed that even with well grazed lucerne the stand becomes thinner as it grows older, but also that valuable winter annuals appear in the crop-plants such as Turksnaels and Italian Rye grass which, by providing mixed grazing, actually improve the value of the pasture. However, when the stand of lucerne becomes thin, it is best to plough the crop residues under and then to grow non-legumes on the land for several years, after which the land is refitted for a further period of lucerne.

Lucerne as a Soil Improver.

It would not be fitting to end an article on lucerne without paying tribute to the wonderful soil-improving qualities of the crop. When lucerne is grown it produces an extensive tap-root system, which opens up the deeper layers of the soil and which, when rotted, adds much organic matter to the soil. In addition it fixes large quantities of nitrogen in the soil, available for plant use. It veritably rejuvenates worn out soils, and crops grown on ploughed-over lucerne lands are always luxuriant. The improvement effected lasts for several years under the conditions of the Winter Rainfall area. At Elsenburg, for example, three excellent grain crops in succession have been grown after lucerne, where normally it is not possible to grow a second grain crop in succession, and the yields in each year were roughly 60 per cent. higher than those normally obtained.

Dryland lucerne has already been tested in most parts of the Winter Rainfall area, either at experiment stations or in co-operative experiments with farmers. With the exception of the south-western districts, and the poor sour Table Mountain sandstone soils of the mountain regions, the tests have been most successful. The most gratifying result is the fact that on most farms where tests have been conducted, the farmers are now extending their acreage of dryland lucerne. With its hardiness, its value as a succulent nutritious feed crop, and its soil improving qualities, dryland lucerne will yet prove to be the salvation of the Winter Rainfall area.

The Control of Vegetable Pests.

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THE pests discussed here include insects, snails, slugs, millipedes and mites. Since space is limited, more attention will be devoted to control measures.

When the control of pests is discussed the farmer is immediately inclined to think of poisons, sprays, fumigants, etc. It is good and necessary that he should know about such remedies and have small supplies, for example, of arsenate of lead or calcium arsenate and nicotine sulphate or nicotine dust available on the farm. He should, on the other hand, also know what effective steps can be taken before the use of poisons becomes necessary. The latter are now expensive and difficult to obtain and there is the further disadvantage that poisons also kill many useful insects. A number of supplementary measures will therefore be indicated before the use of poisons is discussed.

1. *Clean gardens.*—A garden that is not kept clear of weeds and other unnecessary plant growth will be infested with all kinds of pests. The sides of furrows, patches of uncultivated ground and the grass along fences or hedges are all breeding and hiding places for such pests as snails, slugs, cutworms, and the black sandmite. Large numbers of slugs, snails and millipedes will also congregate under heaps of grass, in dense shrubs where dry leaves, etc., accumulate, in stone piles and similar places. An extensive cleaning up campaign should therefore be started towards the close of winter. Soils which will be planted first, as well as the surrounding soil, should be cultivated (ploughed or dug up). Grass and shrubs, dry leaves, etc., which are removed from furrows, hedges, etc., should immediately be taken to a compost heap where the material can be turned into compost. It should not merely be stacked into heaps. This work should be continued during the following spring and summer, and places which have been cleared should be kept clean. The soil between the vegetable plants and between the rows must also be cultivated regularly in order to control the weeds.

It sometimes happens that a farmer pays no further attention to a crop which proved to be a failure for some reason or other. Such a crop may, however, offer an excellent breeding place for pests. Take, for example, a bean field on which the crop has been severely damaged by bean bug (ysterbek). Before the farmer can even think of planting beans again, the infected plants should be ploughed under and all dead plants, grass or anything else that may possibly harbour the pest should be burned. This also applies to the crop remains on old cabbage fields which are often severely infested with such pests as cabbage moth, bagrada bug, stink bug, etc.

Mention should also be made here of plants on which insects can survive from one season to the next. The cabbage moth and bagrada bug can breed on any plant of the cabbage family, including the weed wild mustard (ramnas). The potato tuber moth can also breed on the thorn-apple (stinkblaar), tomato or Cape gooseberry plant. Beet-aphids are also sometimes found on nightshade (nastergal) and pigweed (misbredie). The farmer should therefore endeavour to become aquainted with and eradicate those plants and weeds which may possibly harbour a pest.

2. *Soil cultivation.*—This is another important method by which some pests may to a certain extent be controlled. Plants will grow

better on well cultivated soil and strong plants will recover more quickly from damage than weak plants. That is not all. Many pests spend part of their life in the soil so that if the soil is repeatedly cultivated at the right time, conditions are made so unfavourable for them that large numbers will perish. One of the oldest methods of controlling cutworms is to plough the soil towards the end of winter and to clean cultivate it for as long a period as possible.

To control eelworms*, the soil is clean cultivated for a year or longer. No vegetation is allowed and the soil is dry cultivated during the dry season so that it can dry out; the worms die through lack of moisture and food. This kind of treatment would also control any other pest in the soil and it is strongly recommended for soil on which seed beds are to be made.

3. *Regular inspection of vegetable gardens.*—It is essential that the farmer should inspect his seed beds and transplanted vegetable at least twice a week. He will then notice in good time whether damage is being done and will therefore be in a better position to take the necessary steps for effective control measures before serious damage has been done. It so often happens that the farmer asks for advice after the major portion of his crop has already been destroyed. Beetroot and spinach plants are sometimes attacked by plant lice which cause the leaves to curl up at a fairly early stage, with the result that the insects are protected and control measures made impossible. Such a situation cannot arise if the plants are inspected regularly and treated in time.

4. *The use of traps, collection by hand, etc.*—It often happens that when a person is advised to catch garden insect pests by hand he is inclined to treat the advice as a joke, and the work as an unneccessary waste of time. Such advice naturally does not apply to all pests and under all circumstances, yet this method of insect control is sometimes very effective, as, for example, in the case of small gardens where snails, cutworms, and caterpillars could be collected by hand. A valuable hint in this connection is to provide suitable places in which pests can harbour. If, for example, grass that has been pulled up or hoed is stacked in a heap, large numbers of snails, millipedes and crickets will be found under it the next day. A wet bag or a board placed on damp soil, will also serve as a suitable trap for these pests which can then be crushed under foot or killed in some other way. In this simple way the number of insects or other pests can be considerably reduced.

5. *Use of Poultry.*—Fowls catch numerous kinds of small insects, etc., by scratching them out of the soil or by pecking them off plants. In certain areas snails can easily be kept under control by ducks and turkeys. The bagrada bug, which sometimes causes serious damage to cabbages and related plants, is readily eaten by fowls. If such pests are found in the garden at times when poultry can do no harm to the plants, the farmer will find this a very effective method of controlling them.

Use of Poisons.

A. Stomach Poisons.

By this is meant those types of insect poisons that are ingested by the pest together with its food. This type of poison is usually used against pests which devour parts of the plant.

The following are examples of such pests, viz., locusts, many kinds of larvae or caterpillars, beetles, snails, etc. If plants on which

* See *Farming in South Africa*, November, 1942.

such pests feed are treated with a stomach poison, the pests are forced to ingest the poison together with their food. The two poisons commonly used for this purpose are *arsenate of lead* and *calcium arsenate.* Both are in the form of a white powder, which can be either dusted or sprayed on the plants.

Spray: Arsenate of lead or calcium arsenate, 2 oz.; water, 4 gallons; spreader, 1 teaspoonful.

First mix the poison with a little water and then add the rest of the water. Use the spreader according to the directions of the manufacturer. If a suitable spreader is unobtainable, the addition of a cup of milk is sometimes recommended. The mixture *should be stirred well all the time it is being used*, otherwise the poison will settle and unsatisfactory results will be obtained.

Dust: Poison, 1 lb; diluent, 4 lb.

Mix the dust very thoroughly before applying it. Use a diluent like Kaolin (a fine light coloured clay in powdered form) or fine slaked lime of good quality.

Dusting should preferably be carried out early in the morning since there is usually no wind at that time of the day. It is also an advantage if there is still dew on the plants since the poison will then adhere better.

Both dusting and spraying should be done thoroughly so that all parts of the plant above ground will be completely covered with the poison. In the case of rapidly growing plants new leaves will be present after a few days and it will therefore be necessary to repeat the treatment after about 8 or 10 days.

It should always be borne in mind that arsenic in any form is poisonous to man and beast. Arsenate of lead and calcium arsenate should therefore be used with discretion. Spinach and beetroot plants, for example, should be treated only while they are still very small. Cabbage and cauliflower plants can be treated in the seed bed and also dipped in the spray when they are transplanted. After that they can again be treated, if necessary, until the heads start forming. After that, treatment should rather be discontinued. Tomatoes are sometimes treated for caterpillars which eat holes into the fruits, but then all visible signs of the poison should be washed or wiped off the fruit before it is marketed.

The use of poison bait: The following is one of the oldest recipes for the preparation of poison bait: paris green, 1 lb.; bran, 25 lb.; sugar 4 lb.; water, approximately 2 gallons.

The poison is mixed with the bran in the dry state and the sugar dissolved in the water. The sugar water is then used to moisten the poisoned bran. After all the water has been added, the mixture is stirred thoroughly. Two lb. calcium arsenate or 2 lb. arsenate of lead can be used instead of the paris green. It is often recommended that about 50 lb. finely chopped green material such as green feed, cabbage leaves, etc., be used instead of 25 lb. bran. In that case, less water must be used. The writer found that the larvae of the moth *Euxoa subalba* could effectively be controlled with a bait consisting of 25 lb. bran and 2 lb. calcium arsenate moistened with water. This bait may also be used to control the snail *Helix pisana*. The bait is broadcast over the infested soil at the rate of approximately 50 lb. dry bran per morgen. Up to twice this amount will have to be used, however, if the infestation is very severe.

For cutworm the bait is broadcast after the soil has been prepared and a day or two *before* planting. The poison will not be so effective if it is broadcast after the field has been planted.

For snails, ground beetles, etc., the poison is broadcast mainly where damage is noticed and near the hiding places of the pest. One treatment before planting time will also reduce their numbers.

It is advisable to broadcast the bait on a cool day or after sunset, otherwise it will dry out and not be devoured so readily.

In this respect the Riply bait for cutworm control has a great advantage. It is prepared by dissolving 6½ oz. sodium fluoride in 2 gallons of water. The poison is then poured into a paraffin tin which has been loosely filled with pieces of prickly-pear leaves that have been chopped with a heavy knife to the size of the top of the thumb. The mixture should stand for about 12 hours and be stirred several times. The pieces are then scattered over the infested soil. Fresh pieces of prickly pear leaves must not be placed in the solution, which should be used only once.

A liquid bait to control the cucurbit fly: Arsenate of lead powder, 1½ oz.; or sodium fluosilicate, 1 oz.; sugar 2½ lb.; water, 4 gallons.

The poison mixture is stirred continuously while being used. The operator draws the poison up in a garden syringe, walks along the rows and at intervals sprays some of the poison in the air so that it settles on the leaves in the form of small drops. Leafy shrubs and trees growing in and around the garden should be treated in the same way as they also harbour the fly.

The first application is given when the first flowers appear on pumpkins or other cucurbits. The treatment is repeated at intervals of from 8 to 10 days. In areas where the pest is very troublesome, it would be advisable to continue with the applications until the pumpkins begin to harden. Isolated pumpkins which become infested should immediately be removed and destroyed.

B. Contact Poisons.

In this group are classified those substances like oil, nicotine, sulphur, pyrethrum, derris root, soap, etc., which kill insects on coming into contact with them. These poisons are, therefore, generally used to control those insects, e.g., plant lice, which insert their mouth parts into the plant tissues in order to feed.

The best known contact poison in this country is nicotine and is sold in three forms, namely, tobacco extract containing 7 or 8 per cent nicotine, a liquid containing nicotine sulphate with 40 per cent. nicotine, and nicotine dust, a white powder containing 2 per cent., 4 per cent. or more nicotine. The spray is prepared as follows:—

Nicotine sulphate (40 per cent.), 1 fluid oz. (little more than tablespoonful); or tobacco extract (8 per cent.), 5 fluid oz. (approximately 6 tablespoonfuls); soap, 3 oz.; water, 4 gallons.

Dissolve the soap in a little of the water, which has been heated, if necessary. Add the nicotine sulphate or the tobacco extract to the rest of the water. Add the soap solution and stir will. Use the mixture without delay since it will lose its strength if left standing. Spray very thoroughly so that the mixture can come into contact with all the plant lice as those which are not touched will not die.

Home-made tobacco extract.—Farmers who produce tobacco or who can buy scrap tobacco at a reasonable price can make their own extract (Skibbe: *Farming in South Africa*, July, 1926).

4 lb. Turkish tobacco in 4 gallons water, or 4 lb. Virginia tobacco in 8 gallons water, or 4 lb. Nicotiana rustica in 12 gallons of water.

Crush the leaves and allow to soak overnight in the required amount of water or heat the tobacco mixture without boiling it. Keep it just below boiling point for about 20 minutes. Strain the extract through a piece of cloth or fine hessian and squeeze the remaining moisture from the leaves. Use some clean water to wash the leaves and add some of this water to the extract to bring it up to the original volume. (It should be remembered that some of the water is left in the leaves so that the original 4 gallons of water with the tobacco will produce less than 4 gallons of extract.)

Add 1 lb. soap to every 20 gallons of the mixture and use the mixture as soon as possible after mixing; it loses its strength and becomes useless if kept over.

Nicotine and soap can also be used to control *millipedes* in the soil. The mixture is made slightly stronger than for the control of plant lice. One gallon of the mixture is sprayed over one square yard of the soil with a watering can. It stands to reason that this can only be recommended for the treatment of small patches where many *millipedes* are found, and where no young plants are growing.

Nicotine and oil are sometimes used together as a contact poison, e.g., against the eggs of the bean fly which causes considerable damage during the latter part of the summer. Infested plants begin to wilt when only a few weeks old and it will be found that the stems are brown and swollen just above the ground. This condition is caused by the maggots of a small fly which lays her eggs on the leaves of the bean plant soon after it has appeared above the ground. In order to control the pest the plants are sprayed twice with a mixture consisting of 1 gallon medium summer-oil emulsion, 1 pint nicotine sulphate (40 per cent.) and 99 gallons water. The first treatment is given 4 days after the plants have emerged and the second 4 days later.

Katakilla, which consists of soap and the crushed roots of a certain plant, can also be used for controlling such pests as plant lice and the black sandmite. This insecticide is mixed with water as recommended by the manufacturers and the plants are thoroughly sprayed.

Soap can be used in an emergency to control plant lice and to prevent them from causing serious damage, if other substances are not obtainable. One ounce of hard soap or 1½ oz. soft soap is dissolved in every gallon of water and the insects are sprayed with this solution. More soap will be necessary if the water is hard.

Sulphur is used by the vegetable farmer to protect his tomato plants against virus diseases. What actually happens is that the sulphur acts as a contact poison on the thrips which carry the diseases from one plant to another. By dusting the plants in good time with sulphur and by repeating this treatment a few times, the number of insects is kept so small that little damage can be done.

An effort has been made in this article to give a general survey of the principles underlying the measures applied to control vegetable pests. Only a few pests and the methods to control them have been given above but there are many other pests which have not even been mentioned. The reader is, therefore, kindly requested to write to the Principal, Stellenbosch-Elsenburg College of Agriculture for further particulars in connection with any pest which may occur in his or her garden.

Common Scab, Brown Rot and Internal Brown Fleck of Potatoes.

Dr. B. J. Dippenaar, Stellenbosch-Elsenburg College of Agriculture.

APART from varietal characteristics to which the consumer should pay attention, potatoes, whether intended for table use or for seed purposes, should also have an attractive appearance and possess good keeping qualities, both of which may be seriously affected by the above-mentioned diseases which are of widespread occurrence in the winter-rainfall area and, in some cases, cause very serious losses.

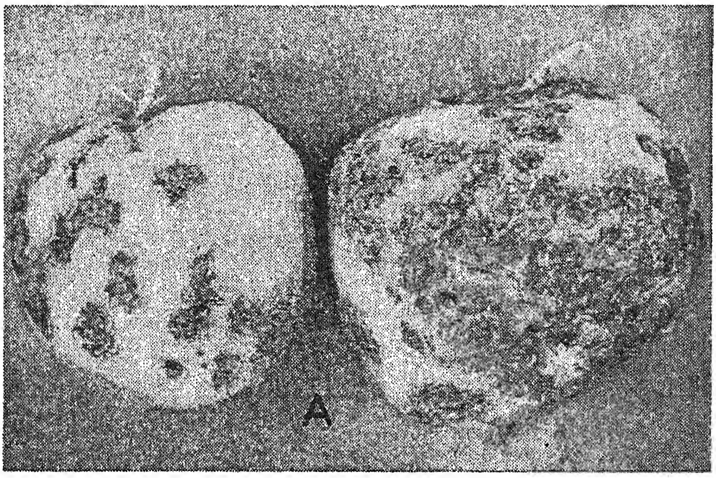

Fig. 1 A.—Common scab in Arran Banner. Here the flecks are deep; tubers may be even more seriously infected than the one on the right.

Many a grower will remember only too well that his potato crop could not be approved by the Government Inspectors for seed purposes, or that a considerable part of it was unmarketable, or realized a lower price merely because the tubers were infected with one or more of these diseases. Therefore, since negligence in regard to, and ignorance of our potato diseases affect not only the producer but the consumer as well, and, in adittion, may render valuable soil useless for the production of potatoes for a longer or shorter period, attention is once again drawn to these diseases.

Common scab affects only the tubers and subterranean portions of the potato plant. Except for beet and turnips, no other crops are subject to common scab to any extent worth mentioning.

The symptoms are more or less circular, brown, pitted or disc-shaped—sometimes raised—corky flecks on the tubers. The size and depth of these flecks, as well as the number present on each tuber, may vary considerably. When conditions favour the development of the disease the flecks may be as much as half an inch in diameter and so numerous as to cover the greater part of the surface of the tuber. Neither the crop yield nor the keeping qualities of the tuber are affected by scab, but diseased tubers are less attractive to the buyer, and are definitely undesirable for seed purposes.

The disease is caused by a fungus (*Actinomyces scabies*) which is spread mainly by means of infected tubers. Soil which has once been badly infected, may harbour the fungi for as long as 20 years. Environmental factors may either greatly favour or check the development of the disease. So, for example, in comparatively acid soils with a pH value of 5·2 or less, scab need never be feared as a factor of economic importance even if potatoes are cultivated in the same soil for three or four years in succession. The application, however, of lime, ash or large quantities of stable or kraal manure

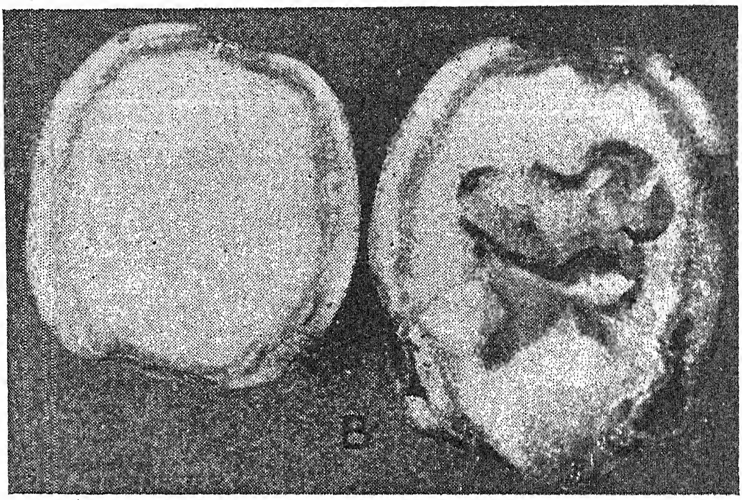

Fig. 1 B.—King George tubers affected by brown rot or bacterial wilt disease, cut lengthwise. The tuber on the left clearly shows the brown discoloration of the vascular ring and rotting of the adjacent tissues as well as the milky excretion of masses of bacteria. The tuber on the right shows a further stage of rotting and a hollow along the vascular bunble near the growing point of the tuber. This tuber also shows a hollow heart which is in no way due to brown rot disease.

which sweeten the soil, will encourage the disease. On the other hand relatively low temperatures and considerable moisture in the soil during the growing period will hamper the development of the disease.

The following is a brief summary of the control measures which may be applied:—

(1) Use only healthy seed potatoes, especially if new soil is used for potato cultivation and if it is intended for the production of several potato crops within a period of a few years. If at all possible, also disinfect the tubers by immersing them in one of the following:

Chloride of mercury (corrosive sublimate), 2 ounces in 12½ gallons of water for 1 hour; formalin, 1 pint in 30 gallons of water for 2 hours; or an organic mercury compound such as Aretan for half a minute. The disinfection of seed will not help much if the soil is already badly infected with the causal organism.

(2) Lime, ash, etc., should not be applied to the soils with a pH value of 5·2 or more. It should also be borne in mind that heavy applications of kraal manure may have the same effect as lime on common scab. On soils which are already badly infected, crop rotation should be practised. The application of sulphur will also cause the

soil to become more acid and so decrease infection. The application of sulphur is an expensive process, however, and may even yield disappointing results during the first year, especially on loamy and clayey types of soil. The quantity of sulphur to be used per morgen will depend not only on the acidity but also on the nature of the soil, e.g., whether it is sandy or loamy. The nearest College of Agriculture should always be consulted first in this connection. In the case of soil which is still new or comparatively free from infection, but which has an acidity exceeding pH 5·4, it is a very sound policy to plant potatoes only at intervals of two to three years.

Brown Rot or Bacterial Wilt Disease.—Both the grower and the consumer find this one of the most unattractive and injurious diseases

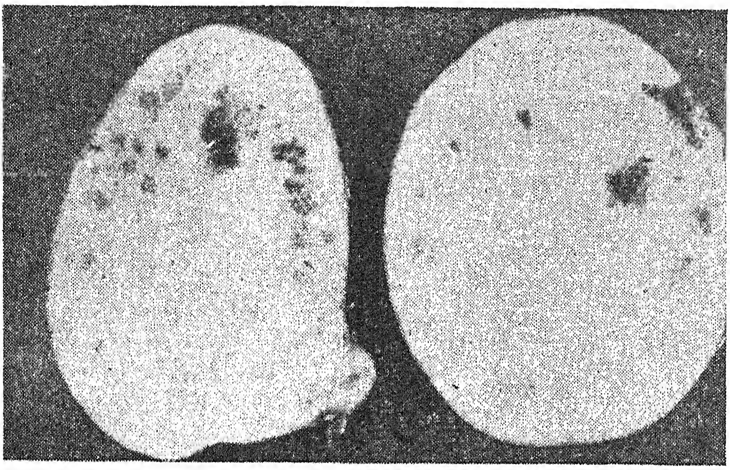

Fig. 1 C.—Dunbar Standard tubers affected by internal brown fleck which occurs in the flesh of the tuber and on the outside of the vascular ring. As a rule, the flecks are more numerous near the growing point than at the stalk end.

with which the potato tuber or plant can be infected. Affected plants will either die prematurely or fail to yield a crop, or if infected at a late growing stage, will yield tubers which soon rot or have very poor storing qualities. Every plant which dies prematurely or yields early-rotting tubers is a total loss, so that the crop reduction due to brown rot may readily be determined. In addition, the causal bacteria (*Phytomonas solanacearum*) are able to survive in the soil for many years and may infect a large number of crops of economic importance, e.g., tomatoes, tobacco, pumpkins, etc., as well as weeds such as thorn-apple. Consequently, infected soils will also be unsuitable to a greater or lesser extent for the cultivation of such crops as tomatoes, pumpkins, etc., in spite of the fact that the fruit of these plants may not necessarily be affected.

The first sign that a potato plant in the field may be infected is a slight wilting of the leaves when the sun is hot. During the night the plant revives somewhat, but the degree of wilting gradually becomes worse from day to day until the plant finally fails to recover and dies.

Plants which are attacked at a late stage of growth are not always easily distinguished from healthy plants, especially when the latter begin to reach maturity. Such infected plants may even

yield a normal crop, but the tubers have poor keeping qualities and are totally undesirable for seed purposes.

A cut through the stem of a badly infected plant will reveal a brownish discoloration of the vascular bundles, and the sap which emerges is always slightly turbid owing to the presence of numerous bacteria. The wilting of the plant is due to clogging of the water vessels by the numerous bacteria present in them, with the result that the plant is unable to absorb moisture from the soil.

In infected tubers the vascular ring also has a brown discoloration. The bacteria move along the water vessels in the tubers where they multiply. At an advanced stage the slimy masses of bacteria break through and emerge from the eyes of the tuber. Soil or sand adheres to such slimy masses which, upon drying, form a raised crust over the eyes of the tuber. A cut through such a tuber will reveal that the tissues immediately surrounding the vascular ring are also rotting. Badly infected tubers may rot while still in the soil, but even those tubers which show no external signs of infection may develop an unpleasant smell and collapse completely during storage. If such potatoes are bagged, wet patches will appear on the outside of the bags. Consequently, buyers on the market do not show much interest in them, and will buy only at the lowest prices.

The best way to identify the disease in wilted plants, the tubers of which show no external sign of rotting is to make a cross cut through all the tubers of such plants immediately below the stalk end, and then place the tubers aside for four or five minutes. If the disease is present, small, round dirty or cream-coloured drops containing bacteria will have oozed out at various points on the discoloured vascular ring of some of the tubers. This is an unmistakable sign of the disease. Another method is to break off the stalk close up against the tuber. If the tuber is infected, the characteristic drops will appear in the injured spot after a few minutes.

The most important environmental factors which influence the disease are temperature, soil moisture and acidity. The disease is always much more severe during summer than during winter, and also worse during a warm summer than during a fairly cool summer. A high rainfall or irrigation is also conducive to the occurrence of the disease and encourages the spread of the bacteria throughout the soil. Hence the belief among growers that potatoes get brown rot if they are irrigated round about noon or during the hottest part of the day. Acid soil, on the other hand, counteracts the disease and infection since it has been established that the causal organisms soon die in excessively acid soil. It may also be mentioned here that such varieties as Katahdin and Green Mountain appear to be much less susceptible than certain other varieties. On the other hand, varieties like Arran Banner and King George are highly susceptible.

Control.—It is essential that only seed potatoes which are free from this disease, should be planted. The grower can never be too careful in this respect. The farmer who buys seed potatoes merely because they are offered as such, without taking the trouble to discover whether brown rot is present or not, will certainly have cause for regret later on. It is preferable that certified seed potatoes should be planted.

In regard to bacterial wilt, it is most undesirable to cut tubers intended for planting if a smaller or larger percentage is infected, since the disease will certainly be transmitted to healthy potatoes by contact or by the knife during the cutting process.

The results will be equally disappointing, however, if healthy seed potatoes are planted on infected soil. Never under any circumstances use infected soil, and take the necessary precautions to avoid infecting valuable soil which is free from the disease by planting diseased seed potatoes.

If only isolated plants show signs of wilting, especially if the soil is not infected, such plants should be carefully uprooted and burnt, or buried deeply outside the potato field. They should never be left lying on the land, or fed to stock. In addition, apparently uninfected potatoes growing on such a field should be lifted as soon as possible and marketed or used, before rotting can set in.

It is extremely difficult and, where this is still possible, very expensive to rid infected lands of this disease. A system of crop

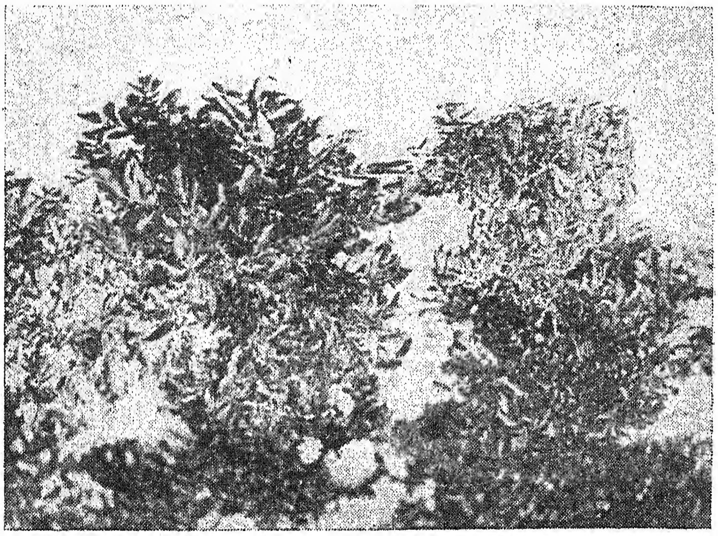

Fig. 2.—Plant of the King George variety (left) affected by bacterial wilt disease next to healthy plants (to the right and rear).

rotation which includes grain and extends over a number of years, will help to reduce the soil infection. It has also been found that the bacteria die out very quickly in soil where the acidity has been brought down to pH 4·0 or lower by the application of sulphur. Later on lime should be applied, otherwise the soil will be too acid for any plant growth. Before applying sulphur and subsequently lime, the grower should first have soil samples tested at the nearest College of Agriculture and should obtain specific recommendations.

Internal Brown Fleck.—The only outstanding characteristic of this disease is the presence of irregular brown corky flecks of different sizes in the flesh of the potato tuber. There is no external indication of infection, and it will also be observed that no discoloration of the vascular bundles or vascular ring occurs. Furthermore, plants which produce such tubers reveal no external features which could in any way be associated with the presence of internal brown fleck.

As a rule, growers are greatly alarmed if seed potatoes show infection on being cut. Fortunately, this disease is not infectious

and will not be transmitted to healthy seed potatoes by means of the knife, or be carried to the soil. It is therefore quite safe to plant such tubers, provided the infection is not so serious that the greater part of the flesh of the tuber is affected. More than one grower who has planted infected seed potatoes has found that the crop was entirely free from the disease or that healthy seed-potatoes produced an infected crop.

Various opinions are held as to the real cause of internal brown fleck. The results of investigations carried out by German research workers indicate that a shortage of soil moisture towards the end of the growing period appears to encourage the disease. Other research workers suspect a shortage of assimilable phosphate to be the cause, and find that the application of lime to the soil decreases the incidence of the disease.

This disease often occurs in the Western Cape Province, sometimes in soils which have an acidity of pH 6·8, i.e., in soils which do not need any lime to promote the growth of the potato plant. The fact remains, however, that potatoes which are cultivated and which ripen during the warm summer months are more seriously affected by the disease, and also that the disease is more prevalent on loam than in clay soils. Dunbar Standard is particularly susceptible to the disease, but a 40 to 50 per cent. infection has also been found in Arran Banner. In one instance Dunbar Standard, planted next to King George, showed 50 per cent. infection as compared with 0 per cent. in the latter variety. A slight degree of infection has, however, also been found in the King George variety.

It is difficult to recommend definite control measures. In the first place, the planting of very seriously infected seed-potatoes should be avoided, since such tubers may germinate poorly or produce weak plants. Also avoid planting such varieties as Dunbar Standard on sandy and arid types of soil where the potatoes will ripen during the hot summer months.

New Bulletins.

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Compost. Reprint No. 34.

The Production of Green and Succulent Feed.

Dr. J. T. R. Sim, Professor of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

A REGULAR supply of feed, sufficient both in quantity and in kind, is essential for successful livestock production. This is necessary in order to ensure regular growth of young animals, gains in fattening animals, a steady milk flow, and the production of good quality wool. In the winter-rainfall area it is not possible to have such a regular supply of the necessary feed, unless special provision is made.

As its name implies, the region is one which enjoys winter rains, but in addition it is one subject to hot and very dry conditions during summer months—in fact the region might equally well be designated "the summer drought area". Under these climatic conditions there is an abundance of natural green feed in the winter period, and nothing but a scanty supply of dry feed in the summer period.

There is virtually no veld available for grazing, except in the north-western Cape, and in the south-western districts. From the time of van Riebeeck the veld has been more and more broken and brought under cultivation for the production of crops of one kind or another, until to-day there is literally no veld left over. Some farmers, it is true, still regard and use the mountains as grazing veld, but this practice of mountain grazing cannot be too severely condemned, for it is always accompanied by burning and subsequent over-grazing. The result is that in order to obtain this practically worthless grazing, huge areas are devastated by fire and laid waste; our natural water-sheds are being destroyed rapidly, and with subsequent erosion large areas of our best soils are being washed away to the sea by floods resulting from the excessive run-off water from the mountains.

Under the difficult conditions of the winter-rainfall area livestock of one kind or another is kept on practically every farm. But livestock is not yet playing the important part in the general farming systems which it should.

The Animals' Needs.

To ensure any degree of permanence in the agriculture of this region, balanced mixed farming, in which animal husbandry forms a very important part, must be practised. But until adequate and regular supplies of the different kinds of feed are available, animal husbandry can never become a truly successful part of the farming system. Farmers must always keep in mind the facts that the lean dry summers inevitably follow the flush winters; that if there is no succulent feed in the mating season for sheep, viz., December., the lamb crop is likely to be poor; that it is in the summer and autumn period that milk production drops; that young animals grow poorly; that the wool may develop a break, and that if the autumn rains are delayed the mortality in the lamb crop is sure to be high. All of these conditions are due primarily to the lack of green succulent protein-rich feed during this period of the year.

Grain feed in the form of oats, barley, rye, "voer" (a popular mixture of oats, barley and rye sown together for the production of mixed feed), and maize is normally available or procurable throughout the year, but while grain or its milled products forms an essential

feed, it is in itself not sufficient for the animals' needs, for it is deficient in protein, minerals, and vitamins, and it lacks succulence. Too many farmers are satisfied that, having produced their feed grain, they have done all that is necessary in the way of providing feed for their livestock, and the idea still persists that this grain together with stubble- and fallowland grazing is sufficient for all kinds of animals.

But in the light of modern knowledge, such a system is quite obsolete in animal husbandry, for it permits of nothing more than the maintenance of grown out draught animals and dry cows; than allowing the Merino or Persian or Afrikaner sheep to eke out a miserable existence on stubble- and fallowland grazing; than keeping a drove of low grade pigs which must scavenge for their feed. Under such conditions there is no possibility of the development of a healthy dairy industry, or of a fatlamb industry or of a poultry industry, unless, of course, farmers are prepared to expend large sums annually on the purchase of the necessary supplementary feeds.

Certain kinds of feed will unquestionably have to be purchased for the more intensive lines of animal production, as, for example, oil cakes and bran. But it is quite possible to produce a great deal of the necessary feed on the farm, and so to reduce purchases and costs, for home-grown feed is generally the cheapest feed, especially when it takes the form of pastures and silage.

Animal feed can be divided into several general categories: (*a*) protein concentrates, such as oil cakes, bran and bloodmeal; (*b*) starchy concentrates, such as grain, oats, barley, rye, " voer ", maize or their milled products; (*c*) pastures; (*d*) soiling or green feed crops; (*e*) roots; (*f*) melons; (*g*) conserved feed, such as silage and hay.

Until a short time ago it was believed that only the winter grain crops could be successfully grown in the winter-rainfall area. Pastures, almost without exception, were confined to the winter growth of " opslag " or volunteer grazing, consisting of Gousblom, Turksnaels, burr Clover, and annual winter grasses, such as wild oats, Haasgras, Klokkiesgras, Bewertjies, etc. Soiling crops (other than green barley), appeared to be unsuited to local climatic conditions and the making of silage was believed to be out of the question on most farms owing to the impossibility of growing maize for silage.

Green Crops for Silage.

But now, after years of experimentation, a number of valuable feed plants have been found to be sufficiently hardy for conditions of this area, and already the use of these crops is changing the appearance of western Cape Province agriculture. The most important of these crops are dryland lucerne, kale, mangels, rape, mixtures of rape with oats and barley and melons. Further, research has revealed that maize is not the only crop which can be turned into good silage. Practically any green crop can be ensiled with the greatest success, provided that a few basic precautions are taken. This finding has opened up wonderful possibilities of supplying the much needed succulent feed in the summer, by making available at that time, in the conserved and very palatable form, quantities of the luxuriant feed grown in the winter months.

In other articles in this issue details of growing the various feed crops, and of conserving some of them as silage and hay, are given. A few remarks are needed here, however, to show just how far each can help towards solving the feed problem, and to bring them all into proper perspective.

It must be realized first of all that no single type of feed alone is capable of solving the feed problem of the area. In addition to grain feed, supplies of both green or succulent and protein-rich feed are essential throughout the year, both for producing and for growing animals. Each form of feed is important, but each in itself is not sufficient to fill the needs of the animal. These forms of feed must therefore be taken together in a feeding programme. The one supplementing the other, so that when properly combined, and with green feed, succulent feed and conserved feed grown on the farm, they can fully overcome the feed difficulties of the summer and autumn and ensure a regular supply of all the necessary forms of feed throughout the year. When the supplies of green feed or succulence from one crop start to diminish, there must be supplies available from another crop which then comes into its peak of production. And when a gap in the green feed supply occurs for which no supplementary crop is available, then that gap must be filled by a supply of conserved feed in the form of silage.

Availability of Feed.

Let us briefly examine at what times of the year the different kinds of feed are available.

Feed grain, and protein concentrates.—Oat grain, barley grain and "voer" grown in the winter rainy season and purchased maize, oil cakes, bran, bloodmeal and lucerne hay are available under normal conditions throughout the year.

Pastures.—Natural pastures in the form of winter annuals will in a normal season become available for grazing about June. Being annuals they can only germinate when the autumn rains arrive, and they must grow out before they can stand grazing. They supply green feed well into October, and to some extent into November.

Winter cereals, such as oats and barley sown for grazing purposes, supply pasturage over a similar period. Mixtures of oats or barley with rape extend the grazing period into December, for rape is a hardy plant and can supply some feed even when conditions start to become hot and dry.

Rape, sown alone as a grazing crop, provides good grazing from June to December.

Italian Rye grass and *Subterranean clover* may be grazed as early as June, but these pastures give their main feed in late winter and spring. By November they have gone to seed and become dry, but in the dry form the plant material is remarkably palatable for livestock.

Of the grasses *Phalaris tuberosa* is outstandingly superior as a pasture for the area. Being a perennial it comes into active growth after the first autumn rains. Consequently, it provides earlier grazing than annual pastures. It produces an excellent quality of pasture throughout the winter and into December. From then on, until the autumn rains, it remains in a resting stage in a relatively dry form.

New Zealand Tall Fescue and *Cocksfoot* provide grazing over much the same period as Phalaris tuberosa, but in general they do not compare favourably with that grass, for they provide less grazing and are more sensitive to the dry summer conditions.

Paspalum dilatatum is another hardy grass, but in the autumn and winter its growth is slow. In the spring it grows strongly and gives much grazing. During the hot dry summer months,

however, even though it remains green, it supplies little feed. In damp vleis, however, it thrives and gives much summer grazing.

Rhodesgrass is likewise a summer grass and is particularly suited to the south-western districts which receive summer showers. It cannot be recommended for the main part of the winterrainfall area, however, for while it supplies good grazing in the autumn and spring, it gives little in the winter or in the summer.

Much the same remarks apply to *Kikuyu* and to many of the indigenous summer grasses which have recently been propagated in nurseries and supplied to the farming public. *Panicum Makarikari* is one exception which is worthy of note. This grass stands the summer conditions fairly well, gives good grazing in the autumn and spring, and even during winter makes some active growth.

The premier pasture for the winter-rainfall area is unquestionably *dryland lucerne*. It is easily the hardiest of all the pasture plants and it supplies grazing of a high quality (for it is protein-rich) from the first autumn rains till well into December and sometimes into January. Not only does it supply grazing over the longest period, i.e., for roughly nine months of the year, from April to December, but the frequency with which it may be grazed, and the total quantity of feed produced, far exceeds that of the other pastures.

It may also be mentioned that the cost of establishing dryland lucerne is approximately one-half of that for establishing grass- pastures by means of rootstocks.

Provision for the Hardest Months.

From the above it is clear that the pastures alone, even when lucerne is included, do not bridge the period of green feed scarcity completely. There still remains the need for succulence and protein during the hardest months of the year: January, February and March and April.

Soiling or green feed crops.—The main soiling crops available are *green barley*, *kale* and *lucerne*. Green barley while a very useful feed does not help in improving the feed supplies for the summer. It is a winter cereal and provides its green feed during the time of plenty.

Kale (Chou Moellier and Thousand Headed) can be of material assistance. The crop is a biennial one and if planted out in August on deeper soils, retentive of moisture, it supplies very nutritious leaves for picking from October to December and from April to September.

When in strong growth, dryland lucerne, while normally grazed, may also be cut and fed green. In comparison with grazing, this method of feeding is more efficient although somewhat more expensive. Small patches of lucerne under irrigation can be of inestimable value during the summer months, when cut and fed green.

Root Crops.—While turnips can be successfully grown in the winter months, they cannot be satisfactorily stored during the summer, and help little towards the solution of the feed problem. *Mangelwurzels* planted out in spring, however, produce a heavy crop of roots which can be harvested and fed from February to July. This crop, therefore, solves in large measure the problem of succulent feed for February and March, and in dry seasons for April and May as well. Further, if an early crop is planted out in May-June, it can supply roots from the end of December onwards. Unfortunately the early crop frequently runs to seed in the spring, and cannot be entirely depended upon.

Melons.—Where sandy soils with a high water table are available, Kaffirwatermelons or Maketaans can be grown. Heavy crops are frequently obtained, and these help considerably towards supplying succulent feed in summer and autumn. Sown in September, the melons can be harvested and fed from February to July.

Conserved Feed.—The importance of conserving feed from the season of plenty to the season of scarcity, cannot be too strongly stressed. The feed can be conserved as silage or as hay. Silage is of special importance from the point of view that it provides feed in the next best form to green feed. Where winter growth of lucerne, oats, barley, kale or any mixture of winter crops is ensiled, the silage is available for feed at any time during the dry summers or during any dry spell. It can thus so supplement the other feeds as to ensure an all-the-year-round supply of green or succulent nutritious feed.

Avoiding Wastage.

In these times of feed shortage, care must be taken that no feed is wasted. If the supply, available in the winter, is more than is needed, that which cannot be consumed must be conserved in one form or another. Preference should be given to turning it into silage, but some can very well be made into hay, which supplies a nutritious form of roughage so needed by animals.

It is clear, therefore, that no single type of feed plant is available which is capable of ensuring a regular supply of feed of the proper kinds throughout the year, but that all the feed plants described must be supplementary to each other in one general system.

Livestock production can progress rapidly if sufficient provision is made for these feeds. In some areas merino sheep will continue to be the major line of animal production, while in other areas fat-lambs will take the lead. But in the more intensive areas the dairy cow, followed by the "better pig" and the productive hen, will yet become major lines of animal production.

Pastures and fodder crops will not oust the good orchard, nor the good vineyard, nor will they eliminate grain growing. But they can and will yet play a very important rôle in company with other major lines of production in promoting a sounder and healthier agriculture.

Better Feeding:—

[*Continued from page* 162.

to be effected by various factors the comparative values given below are merely approximations. About 15 lb. silage is equivalent to approximately 5 lb. hay or 3 lb. concentrate. Roughly speaking, 10 lb. mangolds, watermelons or pumpkins can replace 1 lb. grain mixture. In so far as acorns are concerned, 3 to 4 lb. are more or less equivalent to 2 lb. grain, while pear meal may be substituted pound for pound for grain, if its low protein content is left out of account. As regards potatoes and sweet potatoes, 4 to 5 lb. of these is roughly equivalent to 1 lb. grain, while approximately 1 gallon of skimmed milk or a trifle more may be substituted for 1 lb. of fish meal or meat meal; 4-5 lb. brewers grains can also be substituted for one lb., concentrate in a dairy cow's ration.

Production of Slaughter Lambs.

L. H. Bartel, Stellenbosch-Elsenburg College of Agriculture.

IT is generally very difficult to bring about a large increase in the production of animal products in an established stock industry within a short period, but when stock feeds are limited this is all the more difficult. Moreover, it is also not advisable in a long-term industry like animal husbandry, to effect sudden changes of any magnitude in the system of farming and flock management in order to cope with what will probably be only a temporary demand. Consequently, when the increased production of animal products became essential, methods were sought which would increase the yield, produce larger profits and at the same time in no way dislocate the industry. The production of slaughter lambs is eminently suitable for this purpose.

The only change necessary is that of the breed of ram used. A mutton-breed ram will produce a lamb which can be marketed at a very remunerative price at the age of 4 to 7 months.

Selection of Mutton-breed Ram.

The best ram for conditions in the Western Cape Province is the Dorset Horn, which gives a very fast-growing lamb capable of being marketed at an early age. If the lambs have grown out well and put on sufficient weight, the majority will be graded as "Super". The present fixed price for supers is 12⅜d. per lb. Unfortunately, the supply of these rams is exceedingly limited and it will be necessary to use rams of other breeds.

Although Blackhead Persian rams crossed with Merino ewes give a slower-growing lamb of poorer quality than the Dorset, such rams are cheap, work well, and their lambs can be finished for the market even under comparatively unfavourable conditions.

The so-called ¾ Dorset × Persian rams, i.e. those obtained from a Dorset ram and a crossed Dorset-Persian ewe, are also now being fairly successfully used with Merino ewes. The rams possess many of the characteristics of a Persian, while a varying percentage of the lambs have fat-lamb characteristics.

Treatment of Slaughter Lambs.

The profitability of slaughter-lamb production largely depends upon the rate at which the lambs gain in weight. The farm management should therefore be organized in such a way that the lambs grow as rapidly as possible. In order to ensure this, it is necessary to make provision for nutritious green pasturage for the lambing ewe before and after lambing time. Also take care to ensure that the lambs do not suffer a setback through insufficient feed, particularly while they are still young.

A large percentage of the profits of slaughter-lamb production is sometimes lost owing to the fact that the lambs suffer a setback through worm infestation. Tapeworms in particular, if not controlled by regular dosing, give lambs a setback and it is always a comparatively expensive process to finish such lambs for the market. Regular dosing with nodular worm remedy which is also effective against tapeworms is therefore essential.

If lambs are to be marketed some considerable time after the usual shearing time in the Western Cape Province, i.e. more than 4 to 6 weeks later, they should be shorn at the same time as the other sheep. If this is done, their condition will not be adversely affected

[Continued on page 232.

Crop Rotation in the Grain Districts.

Dr. J. T. R. Sim, Professor of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

YEARS ago the cropping systems on the grainlands of the Winter Rainfall area were sometimes like *wheat-wheat-oats-ouland;** *ouland-ouland-braakland,*† and *wheat-oats-oats-ouland-ouland-ouland-braakland.* In those days farms were considerably larger than they are to-day, and it was possible to rest lands from grain production as "ouland" for several years. After this rest period grain could be grown successfully on them again.

But in the course of time the farms have become smaller and the period devoted to ouland has been more and more curtailed. About twenty years ago a common form of rotation was *wheat-oats-ouland-braakland,* but in recent years the system has been shortened still further, first to *wheat-oats-braakland* and *wheat-ouland-braakland* and finally to *wheat-braakland,* which is the most common form of rotation in use to-day. It may be noted that the ouland period (which was of much value for grazing) has been dropped) consequently the livestock have either to be curtailed in number or else to be neglected. Even the grazing value of the braakland has been reduced to a very low level by the thorough cultivation applied to it to stimulate the growth of the subsequent grain crop.

The system is bad, for with the niggardly treatment meted out to the livestock and the intensification of grain production, nature's balance between plant, animal and soil has been upset, and the system has become nothing less than one of agricultural mining. In this system the grain crops, which are sold and consumed elsewhere, take all they can out of the soil, and each year leave the soil so much poorer than before. It is the road to ruin, and the sooner this is realized, the better. Fortunately the number of farmers who realize the disastrous nature of the system is increasing, and they are all seeking ways and means whereby they may avert the danger.

The faults of the wheat-braakland system are that it destroys the already limited supply of organic matter in the soil, that it exposes the soil surface for long periods to the dangers of erosion, that it encourages the growth of undesirable winter weeds, and that it provides perfect conditions for the increase of soil-borne diseases, such as "Take-all" (Vrotpootjie) and "Doodgaansiekte" (a complex of root-rot organisms). The farmer has become dependent mainly upon his grain crops and if at any time he suffers crop failure for one reason or another, he has practically no other source of income upon which to fall back. He is overwhelmed with work at certain seasons of the year, and at other times he is practically idle. Already the soils are in a poor physical condition—they work with difficulty, for they absorb water poorly and dry out rapidly, break down too readily into a fine condition and crust over all too easily.

It is essential that farmers must break away from this pernicious wheat-braakland system without delay, and that balanced mixed farming, with livestock playing its important rôle, must be restored. Before this can be done adequate supplies of the right kinds of feed must be assured. That such supplies of feed are available is shown in another article in this number.‡

* Ouland—uncultivated fallow used for grazing.

† Braakland—cultivated or bare fallow.

†† See article "The Production of Green and Succulent Feed in the Winter-Rainfall Area" by J. T. R. Sim.

The need for building up the supply of organic matter in the soil is especially urgent, for it is the deficiency of organic matter in the soils of the grain districts which is primarily responsible for poor yields. All measures which can help to overcome this deficiency must therefore be taken. Let us briefly examine the sources of organic matter at our disposal.

Sources of Organic Matter for the Soil.

(1) *Manure.*—The best source of organic matter for the soil is manure, but unfortunately insufficient manure is produced in the grain areas to treat more than a very small portion of the farm adequately each year. Latterly the supplies of manure have become still further restricted, as the farmers find that their sheep do better with free run than when kraaled at night. It is evident that additional means of replenishing the organic-matter content of the soil must be sought, but in these times, when fertilizers and manures are scarce, every effort must be made to ensure that no material which can contribute to the soil's fertility may be allowed to go to waste. Every farmer must strive to produce the maximum quantity of manure on the farm, to conserve as much of animals' urine as possible, and to bring back all crop residues, in one form or another, into the soil.

(2) *Crop Residues.*—The amount of organic matter returned to the soil from the *stubble* and *roots* of the grain crops is entirely inadequate to compensate for that consumed in their production. Where grain is "stripped" or "combined", *long straw* is left on the land, which when later ploughed under, helps considerably to maintain the organic matter content of the soil. Incidentally the long straw greatly impedes the movement of "*run off*" water, and consequently is of much value in the control of erosion.

Straw and *chaff* are also valuable sources of organic matter, and the practices of burning straw stacks and of selling chaff off the farm cannot be too strongly condemned. Straw or chaff used as bedding or in kraals absorbs the urine and increases the bulk of the manure. These residues when returned to the land either as *strawy manure*, or as chaff, help markedly to maintain the soil in a productive condition.

The beneficial effect of chaff may not show up well in the first year of application, when the microbial life of the soil may be at a low level, but thereafter it becomes very evident.

Tests started at the Langgewens experiment station in 1934 have demonstrated that where chaff is ploughed into the soil at braaking time in a wheat-braakland rotation, in quantities equal to that generally produced by a grain crop, namely, 1½ tons per morgen, both the water absorbing and retaining power of the soil is increased, and the yield progressively improved. Where 3 tons of chaff per morgen were incorporated in the soil the results were still better. Where 6 tons per morgen were added the yield was rather badly depressed during the first few seasons, although improved yields were obtained later. In 1940, after four chaff applications, the 3 ton treatment gave a yield approximately 12 per cent. better than where no chaff was added.

In adding chaff to the soil the wisest policy is to start with a light dressing—say 1½ tons per morgen—to prevent a depression in the subsequent grain yield, and thereafter as the microbial life of the soil multiplies, to increase the dressing to 3 tons per morgen.

The chaff should be spread out during February-March on lands to be braaked, so that it may be exposed to the weather and to the

trampling of livestock. In consequence it is already partially rotted when braaked under in July-August. Such land under chaff holds moisture well, consequently, if a dry spell occurs at braaking time, it can be braaked more easily and the ploughing can continue for a longer period than land on which chaff was not spread. In all cases, however, lands which have been dressed with chaff should be braaked early, in order to allow the decay of the chaff to be completed in the same rainy season. If the chaff is not fully rotted then, the decay

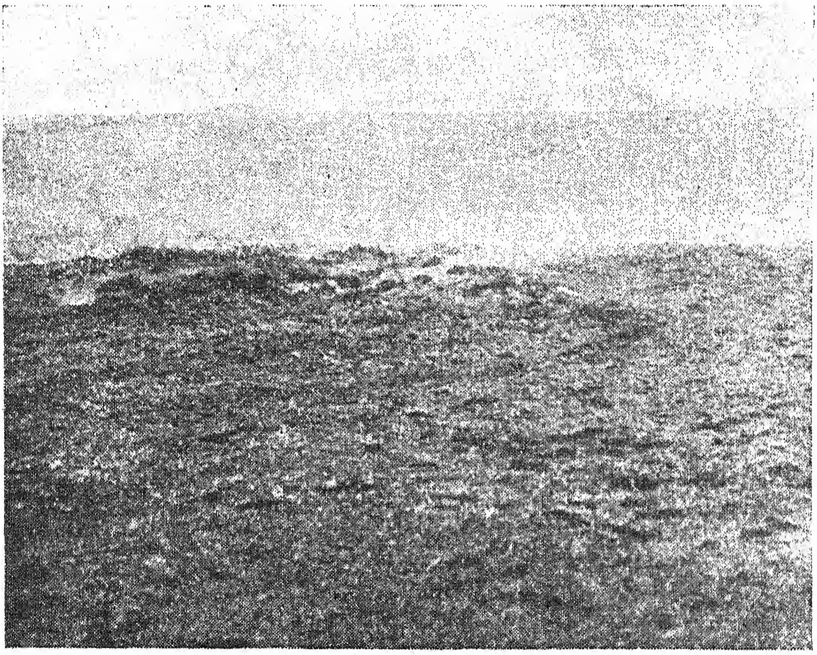


FIG. 1.— The waste of organic matter—a burned-out straw stack.

process goes to completion in the following autumn after the rains have started. This coincides with seeding time and the young crop may suffer badly in consequence.

Chaff containing undesirable weeds, such as Wild vetch (Wilde-ertjie) and Ramenas, should preferably not be applied directly to clean lands, for these lands may become fouled by the seeds of these weeds. For direct application to the land clean chaff should rather be used, and weed infested chaff should be converted into well-rotted manure or compost.

Another effective way of utilizing crop residues is to turn them into *compost* and to bring them back to the soil in this form. As much has already been written on compost making, it is unnecessary to repeat here what has already been said. If the necessary water supplies required for the process are available, this method may also very well be used. It is of particular value in rendering weed-infested chaff innocuous, for when such material is composted the heat developed in the process destroys the germination power of the seeds.

(3) *Green Manure.*—Some years ago it was thought that green manuring with Field Peas might solve the organic-matter problem, and rotations such as *wheat-peas*, *wheat-oats-peas*, and *wheat-oats-*

oats and *vetch-peas* were tested. It was found, however, that not only are the costs of green manuring high, but that under the rather low rainfall conditions of the main grain areas the practice was a failure. Too often the rains come too late to allow the production of a good green manure crop, and too often they stop too early, with the result that there is insufficient moisture in the soil to permit the green manure to be ploughed under properly, or to be rotted satisfactorily, with detrimental effects to the subsequent crop.

From the foregoing it is evident that the fullest utilization of the available manure and plant wastes on the farm, helps much to maintain the supply of organic matter in the soil. It does not solve the problem entirely, however, for the incorporation of these materials in the soil does not compensate *fully* for the organic matter consumed in the production of the grain crops. Still other means must therefore be sought if the organic matter content of the soil is to be maintained at a reasonable productive level, or if it is to be built up to a level capable of high production.

(4) Another source of organic matter is the production of the so-called "*humus-producing*" *crops*. This is a group of crops including grasses, clovers, and lucerne, etc., grown as pastures or for hay, which by nature of their extensive root systems build up reserves of organic matter in the soil. Extensive tests have been conducted on these crops with the object of selecting out those most suited to the conditions of the Winter Rainfall Area. The prolonged dry conditions of the summer have proved to be too severe for the majority of them, in some parts a few have met with a fair measure of success, but only one crop has proved to be really successful. That crop is lucerne.

Dryland Lucerne.

The discovery that lucerne can be grown as a dryland crop in most parts of the grain districts has opened up great possibilities for improved farming in the Winter Rainfall Area. The lucerne can be grown as a grazing crop for 3½ to 4 years, allowing greatly improved livestock-carrying conditions (for it produces an abundance of nutritious green feed from April to December) and can then be ploughed under. In the higher rainfall districts the crop can be ploughed under with the autumn rains, just prior to sowing the grain, but in the drier areas, such as the Swartland, it is best braaked under.

During its period of growth the lucerne, being a strong tap-rooted legume, builds up large quantities of organic matter and nitrogen in the soil. The tap root grows deeply into the soil and opens up the subsoil. When the crop is ploughed under, most of the plants are killed, and on rotting they virtually rejuvenate the soil. Ploughed-over lucerne lands absorb and retain water well, they remain in workable condition for a long period, they do not fine down easily or crust over readily. The nitrogen fixed by the crop enriches the soil's fertility. When the crop is ploughed under, a fair number of lucerne plants survive, and these grow together with the grain crops without hindering them in any way. The value of the subsequent stubble land and braakland grazing is greatly enhanced by their presence. In consequence of the improvement brought about in the soil, the yields of subsequent crops are greatly increased. One example taken from Elsenburg may well be given here to illustrate to what extent the productive power of the soil may be built up.

On a 10 morgen field, whose normal grain yield was from 9 to 10 bags of wheat per morgen, dryland lucerne was grown as a grazing

crop for 4 years. Excellent grazing was obtained and each year hay or silage cuttings were made in September to October. In May of the fourth year the lucerne was ploughed under and the soil was worked down. Three weeks later wheat was sown with a fertilizer dressing of 400 lb. of superphosphate per morgen, but no nitrogen. The crop yielded 16 bags per morgen—an increase in yield of 60 per cent. In May of the next year the wheat stubble was ploughed over and wheat was sown, again with 400 lb. superphosphate per morgen and no nitrogen. Again a yield of 16 bags per morgen resulted. In May

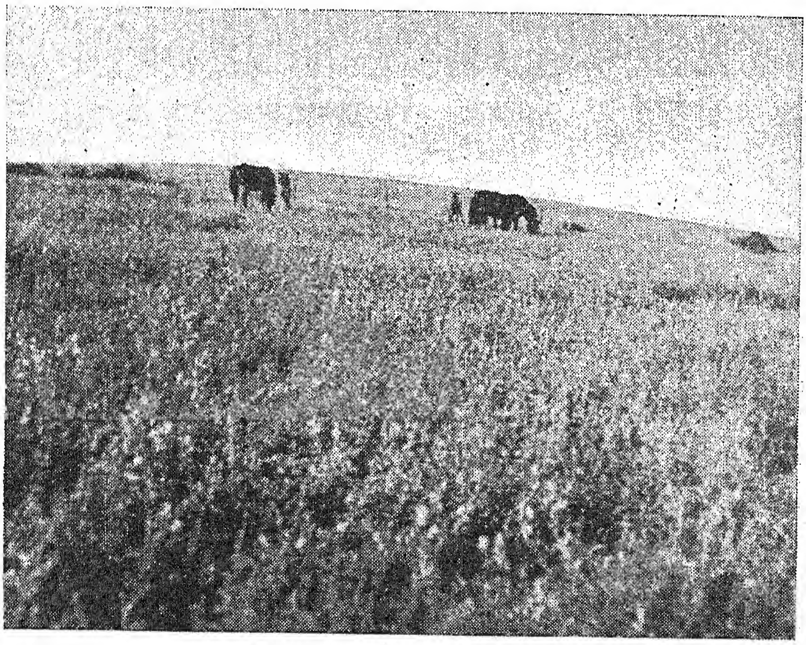


Fig. 2.— Dryland lucerne in the Swartland.

of the following year the land was ploughed and oats was sown with 400 lb. superphosphate and no nitrogen fertilizer, which gave a crop of 16 bags to the morgen. During these three years the stubble grazing was excellent. for it contained a considerable amount of lucerne plants.

With figures such as these little further comment is needed. But it may be mentioned that many farmers who have grown grain on old lucerne lands have also met with excellent success. The 1942 results from rotation experiments at Elsenburg and Langgewens experimental stations have stressed the value of dryland lucerne as a soil improver under very wet autumn and early winter conditions. At Elsenburg wheat following lucerne yielded 18 bags per morgen, in comparison with 5 bags per morgen from wheat grown on braakland. At Langgewens 11 bags per morgen were obtained from wheat sown on old lucerne plots, and 5 bags per morgen from wheat sown on braakland.

It is evident, therefore, that dryland lucerne offers wonderful possibilities as a rotation crop for the grain areas. As a humus-producing crop it can compensate for the harm done to the soil by the

humus destroying grain crops, and can not only maintain the productivity of the soil, but actually build it up to higher levels.

The question that arises is how dryland lucerne can most practicably be incorporated into the farming system in this area. That lucerne must be brought into the system is a matter beyond doubt, but its inclusion presents certain problems which will require much thought before the ideal type of rotation is evolved.

At present while short-cycle rotations such as wheat-braak; wheat-oats-braak; wheat-ouland-braak are practised on the majority of grain farms, each farm is usually divided into a few very large camps. The inclusion of lucerne in the rotation will require a reorganization of the farm lay-out, for it is not possible to put one large camp under lucerne without badly upsetting the rotation of crops on the remaining camps. We believe that the best results will be achieved by changing the system from a short-termed rotation to a long-cycle rotation, and by bringing lucerne into the system gradually over a period of years.

For example, a 240 morgen section of the Langgewens experiment station is gradually being brought into a 12 year rotation of *lucerne-lucerne-lucerne-lucerne and braak-wheat-braak-wheat-braak-wheat-braak-wheat-braak* on 12 camps of 20 morgen each. Each year one 20 morgen camp is sown to lucerne. After three and a half years each lucerne camp in turn is braaked and the following year sown to wheat, as called for by the rotation system.

The perfect type of rotation should not include any break or fallow periods, for not only are these periods non-productive, but they expose the soil to all the dangers of erosion. The reason that such fallow periods occur in the above rotation is that the Langgewens area is one subject to a very limited rainfall (11 to 13 inches, occurring mainly from May to September) and the fallow periods preceding the wheat appear to be necessary for soil moisture and weed control, and to permit of early sowing in dry soil if the autumn rains are delayed. Possibly in the course of time it may be found possible to eliminate the fallow period in these drier parts, but up to now the solution has not been found.

Once the above rotation is in full swing, one-third of the lands will be under wheat (or some under oats if desired), one-third will be under lucerne and one-third will be braakland. In comparison with the wheat-braak system, less land will carry grain, but in view of the higher yields to be obtained from an improved soil, the total yield is not likely to differ greatly from that obtained under the old system, while the production costs per bag will be materially reduced. The large area under good grazing makes possible a vastly improved livestock industry, including fatlamb and milk production. Finally, such a rotation comprises a constructive farming system whereby considerable quantities of grain can be produced without depletion of the soil.

Some farmers will no doubt object to such a system, giving as their reasons the extra expenses of fencing, of providing more drinking dams, the greater trouble in ploughing the smaller 20 morgen camps in comparison with that for the larger 40 or 60 morgen camps, and so on. These objections are real difficulties, to be sure, but it must be realized that just as in the case of reorganization of a business concern to put it on a sounder and more profitable basis, so in the case of farm reorganization there must be a certain amount of capital

outlay. But once the reorganization is complete the farmer's efforts will be rewarded by better returns which will more than compensate for the expenditure involved. The solution to most of these difficulties is to bring about the reorganization gradually, so that the expenses are spread over a period of years.

While lucerne rejuvenates the soil, the other sources or organic matter, such as manure, chaff and compost, dare not be left to go to waste, but must be used as supplements to the lucerne. The manure and compost can probably be used to best advantage on the smaller camps near the homestead devoted to green-feed production, and on lands on which new lucerne is to be sown. The strawy manure and

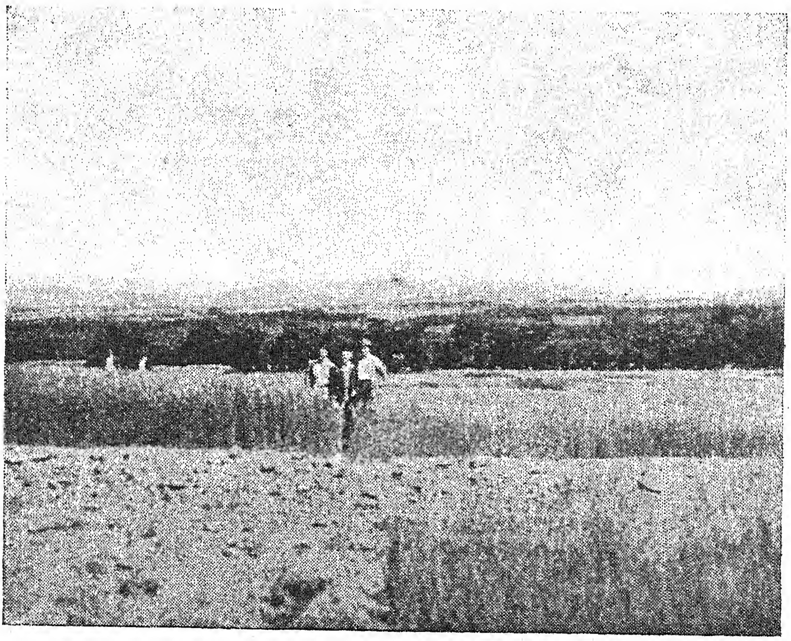


FIG. 3.—Rotation experiments, at Elsenburg. Left—wheat after lucerne, right—wheat after "braak".

the chaff can probably best be used in the above rotation by being applied in the 8th and 10th years when the beneficial effects of the lucerne may be diminishing, and possibly also in the 12th year in preparing the soil for the new lucerne in the next cycle of the rotation.

In the higher rainfall districts more intensive rotations appear to be practicable. The crop succession from Elsenburg, quoted above, is an example in point. From those results an 8 year rotation such as *lucerne-lucerne-lucerne-lucerne-wheat-wheat-oats-oats and rape for grazing* appears to have sound practical possibilities. This rotation and that being applied on a farm scale at Langgewens are already under test in exact experiments. With our present knowledge, these types of rotation appear to be the most practical, but they are by no means necessarily the last word on the matter. As time goes on, experience, experimentation and thought will undoubtedly contribute

valuable ideas to the solution of the problem, until ideal rotations which can stand up to all tests are finally evolved.

In the meantime let us each year put more lands under dryland lucerne, even if they may not yet form part of a perfect rotation system, for we can do this with the sure knowledge that such lands will be greatly improved in productive power, both in terms of live-stock and of grain, and that such practice is forming the basis for future permanence in the agriculture of the grain districts of the Winter Rainfall Area.

Production of Slaughter Lambs:—

[*Continued from page 224.*

by the heat. In fact, they are thriftier and gain weight more readily when shorn.

Although the ideal policy is to slaughter lambs while they are still in sucker stage, it sometimes pays under certain conditions to wean the lambs before marketing. When the flock is still comparatively large and the available grazing limited and inadequate for both ewes and lambs, the lambs should be weaned and placed on the good grazing. A lamb always loses weight shortly after it has been weaned. Consequently, lambs should under no circumstances be weaned shortly before marketing.

The existing fixed prices are for all weights; the lambs can thus be marketed at any weight. Since concentrates are very scarce and expensive at present, lambs should be marketed at the weight which they will reach on the grazing. If the lambs are likely to reach a dressed weight of 40 lb. on the available grazing, producers should not market them at the old standard weight of 30 lb.

Slaughter-lamb production is at present an exceptionally remunerative branch of stock-farming in the Western Cape Province, and since it can be practised without the necessity of effecting any considerable changes in the existing farming system, it should receive the serious attention of all grain-farmers.

Carbon Tetrachloride (Liver Fluke Remedy).

This remedy, which is recommended for the treatment of liver fluke in sheep, goats and cattle and certain worms of horses and fowls, is now obtainable from the Division of Veterinary Services, Onderstepoort, as follows:—

	s.	d.
In 1 gallon (4,500 c.c.) tins	15	0
700 c.c. tins	2	6

The remedy is issued only for cash with order or C.O.D. and is sent free by rail.

Particulars concerning its use are also obtainable.

Nodular-worm Remedy.

"Owing to the lack of certain raw materials, the Division of Veterinary Services at Onderstepoort is unable to manufacture further supplies of Nodular-Worm Remedy. It is uncertain as to when the raw materials will again be on hand, but it is anticipated that the manufacture of the remedy will again be commenced with towards the end of February or beginning of March 1943 when the necessary publicity will be given."

Farming in the Sandveld.

O. S. Heyns, Extension Officer, Piquetberg.

THE Sandveld area of the south-western Cape Province extends along the west coast from Saldanha Bay to Lamberts Bay. The soil in this area consists mainly of sand. It is unfertile and the rainfall is low and uncertain. In addition, strong winds prevail practically throughout the year so that the soil easily drifts once it is ploughed. It is therefore clear that the sandveld area is altogether unsuitable for crop production and is more suited for extensive livestock farming.

Owing to the comparatively dense population which had to be fed, farmers began to plough the soil in the Sandveld and to cultivate cereals. The attractive prices for wheat resulted in the farmers concentrating on wheat production to an ever increasing extent. More or less the same thing has happened with oats. In most cases, however, the production of oats and wheat on the soils of this area is uneconomical, and in addition, these unproductive lands are being transformed into useless and dangerous wind-eroded patches.

Why preference should be given to Rye.—For the following reasons, rye can be produced much more economically than wheat and oats on the sandy soils of this area:—

(1) Oats and wheat are more leafy than rye; consequently their water requirements are higher.

(2) In the flowering stage oats are very sensitive to drought with the result that the crop is frequently a failure owing to the uncertain rainfall in the Sandveld during August and September.

(3) On sandy soil rye is more resistant to strong winds than wheat and oats. The seedlings of the last mentioned two crops are frequently destroyed by strong winds in May and June.

(4) On poor sandy soil rye thrives better than wheat and oats. It requires less fertilizer and can consequently be grown more economically. The cost of fertilizing rye is only half of that for wheat and oats.

(5) Rye can simply be grown on stubble lands or on land not previously cultivated, whereas in the case of wheat and oats the soil must be fallowed during the previous season.

(6) Rye stubble is tougher and takes longer to disintegrate. This is an advantage on drift-sand soil, since the stubble remains intact for a longer period and prevents the soil from being blown away.

In the past, prices for wheat and oats were more attractive than those for rye. This fact encouraged farmers to increase their production of oats and wheat. At present, however, rye prices are more in relation to those of wheat and oats, and in addition, are now fixed and guaranteed. There is therefore no reason why farmers in the Sandveld should not concentrate exclusively on rye production. If the Sandveld farmer decides to sow rye on his old lands, there will be no necessity for him to fallow virgin soil for wheat. Fallowing of virgin soil always results in the destruction of natural grazing, and favourable conditions for the development of patches of drift sand are created.

Control of Driftsand Areas.

Where unproductive patches of drift sand already occur on a farm, every effort should be made to cover these with some kind of vegetation in order to check the process of encroachment. The first step

 [Continued on page 236.

Vegetable Seed Production.

Prof. J. H. Neethling, Department of Genetics, Stellenbosch-Elsenburg College of Agriculture.

THE production of vegetable seed is a highly specialized industry. In abnormal times the need for reliable seed compels farmers to pay special attention to this particular aspect of the matter.

In the event of a shortage of seed, it is the vegetable farmer who suffers the greatest loss, for in such circumstances he is apt to face the risk of using any seed which may still be available and, apart from the uncertainty which he must endure while his crop is still developing, the crop may, if not an actual failure, yet be of inferior quality.

Vegetable production is a comparatively intensive industry entailing high costs, and a crop failure therefore means a serious loss to the producer.

As a rule it is impossible to determine which seed has been obtained from good and which from inferior mother plants so that in so far as the reliability of the seed is concerned, the vegetable farmer is entirely dependent on the good faith of the person supplying that seed.

Seed merchants may genuinely attempt to sell reliable seed, but they are to a large extent dependent on the seed producer. Every reputable firm will endeavour to maintain its reputation by selling only reliable seed but in view of the abnormal conditions prevailing at present their difficulties have naturally been greatly increased.

The production of good seed naturally demands that the enterprising grower should have an intimate knowledge of the particular crop from which he intends to produce seed.

A basic fact to take into account is that all people cannot claim the same ability. Some growers succeed in raising and developing a crop even under less favourable circumstances whilst others succeed or achieve only a partial measure of success under the most favourable circumstances.

Persons who concentrate on seed production can undoubtedly obtain great success and this occupation may become a valuable side-line or even a major enterprise.

It is impossible to give detailed directions in this article. Consequently, only a few warnings and hints in connection with the main vegetable crops will be given.

Requirements for Seed Production.

Most vegetable seeds are produced in sunny areas where dry climatic conditions prevail from the time that the plants flower until the seeds are ripe. Cauliflower and vegetables like celery are exceptions to this general rule since cauliflower prefers a moister climate. This probably explains why an area like the Gamtoos Valley is so suitable for the production of Cauliflower seed. Strong winds at the time when the seed begins to ripen are often harmful, since they may seriously damage the seed crop.

The principal requirement for seed production is the cultivation of a normal crop such as that generally required in practice for a vegetable crop. The reason for this is that such a crop must serve as a criterion for determining whether that crop is actually suitable and, above all, whether the variety being grown conforms to the

desired standard of reliability, a factor which can be ascertained from the degree of uniformity in all the plants.

If the plants are not all of a definite type, the variety should be regarded with suspicion. For the production of reliable seed it is therefore essential that the kind used for seed-production purposes should be of sound origin and highly suitable as regards the quality and quantity of vegetables raised from it.

Since, in the past, South Africa was mainly dependent on imported seed for certain kinds of vegetables, it was often extremely difficult to conform to this requirement as regards the kind.

In addition, it should be borne in mind that seeds imported during recent years, were not always grown under normal conditions and, consequently, were often not of the desired quality. Crops grown from such seeds are already beginning to show that the seed was not altogether reliable, this being due to the fact that it did not receive the careful treatment which is so essential in seed production. Whenever possible preference should be given to seed obtained from South African growers of whom there are still a few and who even before the war concentrated on the growing of good reliable seed.

It should be remembered that the external appearance of seed cannot serve as an indication of its value. It is virtually impossible to distinguish Kohlrabi seed for example, from that of other plants of the cabbage family by external appearance. Consequently growers are compelled to rely on the word of the producer alone, and for that reason the co-operation of seed growers is urgently sought in the matter. In no circumstances should growers offer inferior seed for sale, since such seed inevitably produces poorer yields which mean a loss to the vegetable grower.

Two Different Groups of Crops.

In seed production crops can be divided into two main groups viz., (*a*) annuals which develop seed during the same season, e.g., beans, peas, lettuce, tomatoes etc., and (*b*) biennials which develop seed during the following season, e.g., cabbage, kale, rape, onions, beetroot, mangolds, carrots, turnips, etc.

There are, of course, certain crops which roughly half-way fall between these two groups. In the case of biennials it is necessary to transplant the mother plants in beds where they can run to seed.

Since vegetables are generally cross-pollinated (except peas and beans), it is essential that the seed grower should grow only one variety of seed unless he can transplant the different varieties where the beds will be at least 500 yds. apart. Sometimes the different varieties do not all flower at the same time, so that there is then no danger of cross-fertilization.

In the case of annuals, assuming that the variety is of the desired quality and that all plants are typically uniform as is expected of a variety, the grower can select and mark the best plants prior to marketing his vegetables. The selected plants are then allowed to run to seed which is then harvested as soon as it has reached a proper degree of maturity. In the case of biennials the grower marks the best of the typically uniform plants for mother plants after having satisfied himself that the variety possesses the desired qualities. It is suggested in the case of cabbage plants, for example, that the grower should also market the heads of selected and marked plants. The stalks of these plants are then lifted and trans-

planted in soil which has been well prepared beforehand. Plant the stalks in rows 30 inches apart, with a spacing of 30 inches in the row. Bulbs and tuber crops; such as turnips, carrots, beet-root, onions, etc., should be inspected when they are lifted. These plants are then transplanted again in the same way as indicated for cabbage. As for onions, the bulbs must be stored for transplanting later at a suitable time, but in this case it is essential to plant the bulbs closer together in the rows.

In order to avoid loss, it is necessary to harvest the seed after it has reached a certain degree of maturity and also to give it an opportunity to ripen properly. The seed stalks of cabbage can be harvested after they have reached the yellow-ripe stage for they will then ripen further. In the case of beet-root the grower will have to decide when the majority of the seeds have reached the ripe stage. Carrot seed must be harvested as the seed heads ripen.

Certain cabbage varieties do not set seed readily, since in some of the dense-headed varieties such as Copenhagen Market, for example, seed setting is apparently dependent upon the plants being subjected to a cold temperature. On being transplanted the stalks of these varieties are inclined to produce another crop of smaller heads which can be cut cross-wise with a knife to enable the flower stalks to emerge from the head. It should be borne in mind that cauliflower, cabbage and other brassicaceous plants are readily cross-pollinated if the flower at the same time and are near enough to each other. In the case of cauliflower a selection of the best plants should be made. The head of the cauliflower is itself a form of inflorescence. Selected plants are left undisturbed in the soil so that they may run to seed. If the head is very densely packed a requisite in cauliflower—the centre of the head may be cut out. This operation serves as a form of pruning, the object being to obtain a better distribution of the flower stalks.

The hints given in this article merely serve as a general guide in the case of a few kinds of vegetables. The problem of seed production is receiving special attention, and particularly with a view to prevailing conditions; selection is being strictly applied with the object of producing small quantities of good quality seed which may be suitable for further seed production purposes. Since the work is still in its initial stage, no seed is available for distribution as yet. If any grower has an outstandingly good variety he should regard it as his duty to make the best use of it for seed production.

With a view to the future, it is hoped that growers will concentrate on the production of good quality seed of all the leading vegetable crops. This development will necessitate the introduction of some form of seed control, which will enable the producer of reliable seed to reap the benefits of his enterprise, since reliable seed is one of the basic requirements for economical vegetable production.

Farming in the Sandveld:—

[*Continued from page 233.*

which should be taken is the fencing in of such patches, but, owing to the present scarcity of fencing material, this will be a very difficult problem. Possibly the fencing wire from some other camp could be used to enclose the patch of drift sand. The main reason why such patches should be fenced in if the work of reclamation is to be effective, is that animals must be prevented from grazing on, and destroying established plants during the dry months when grazing is very scarce.

[*Continued on page 238.*

The Better Dairy Cow.

Prof. J. H. W. Th. Reimers, Stellenbosch-Elsenburg College of Agriculture.

PRODUCTION of feed of every description is essential in these times, but such production must be accompanied by the selection of better cows for converting that feed into animal products, especially milk. Unfortunately it cannot be denied that much feed finds its way to poor dairy cows, with the result that the total milk production of herds composed of such cows, is entirely out of proportion to the feed consumed. More feed will perhaps be grown this season, but are the cows up to the standard to convert this feed economically into milk?

The limit of production of many so-called dairy cows is about 3 gallons for the Friesland and 2 gallons for the Jersey breeds. Furthermore, feeding for higher production often fails to attain the desired result, because the so-called dairy cow simply puts on fat and becomes a nice standard beef animal. Pouring feed into a dairy cow whose maximum production is about 3 gallons per day, will not bring her production up to 5 gallons per day, but will be a waste of feed which could have been used to feed another cow. If this feed has been given to another more typical dairy cow, the desired 5 gallons would have been produced.

Better Jersey Milk Producers.

There are means of detecting high-production cows and it is possible, without testing cows, to select amongst a herd the better producers.

Many characteristics in conformation in our different grade dairy cows can be used as welcome indications of a good, strongly constituted producer. The farmer observing these characteristics and selecting for them, has more than a fair chance of improving his herd. A good producing high-grade Jersey has usually a fairly deep, though perhaps a narrow breast; lean well attached shoulders; a straight, not too broad or beefy back with deep ribs wide apart from each other; and a spacious belly, resulting in a deep centre-piece. Spring of ribs, so desired in a beef animal, must often be sacrificed for depth of ribs and consequently depth of belly in a dairy cow.

The loins must be lean and not covered with surplus flesh and fat, and must be well attached to the hindquarters; the flanks must be deep. The rump must be long and flat, lean with neatly shaped hips, which must not be course, but may be, on account of the breed characteristic of the Jersey, a little narrower at the thurl and pin-bones.

The thighs must be lean, free of all fleshiness, with plenty of room between them to permit space for the udder. The udder itself must be roomy, mellow when handled, extending far upwards behind the thighs and far forward towards the belly. The teats must be placed well apart and must be long enough to permit easy milking. Milk veins must be prominent. The skin of the animal must be thin, soft, pliable and fatty, and be covered with thin, and fatty hair.

Too much attention is often paid to the shape of the head and horns. Provided the head is refined and lean, the mouth broad, the horns of smooth and fine texture, the shape and other little characteristcs are merely fashion qualities for the stud breeders and on which the milk production is not dependent. To ascertain whether these conformation qualities have really resulted in better produc-

tion, the farmer cannot escape the necessity of measuring and weighing the milk of each cow from time to time. Because the amount of milk produced determines the amount of food to be given, the weighing of milk is very essential for success.

Unfortunately there are no ways of measuring the percentage of fat in the milk, except by way of chemical determination, which is carried out by milk testers. The colour of the milk as well as the layer of cream assembling on top of the milk are only very inaccurate means of determining the fat percentage of milk.

Selecting Friesland Grades.

The characteristics of the high-producing Friesland grade are partly the same as those of the high-producing grade Jersey, though there are differences which must be kept in mind when Frieslands are selected.

Firstly, the Friesland must be bigger and broader and may be a little coarser of bone and a little less lean, while shoulders, back and loin may show a little more covering with flesh.

Secondly, the hindquarters must be more square, the hips may be a little coarser, the thurl and space between the pinbones must be wider, and the thighs may carry a little more flesh on the outside, though at the inside plenty of room must be left for the development of a roomy, broad and deep udder, well attached between the legs.

Though the udder of a Jersey is usually more sqare and reaches further forward, one must pay special attention in the case of a Friesland grade cow to well developed front quarters as lack of development of these parts of the udder is a common fault of this type.

Well placed legs and easy gait are essential in all types of dairy cows in order to facilitate grazing. Badly placed legs and difficult movement often impair the strength necessary to graze during day and night, and such animals often show lack of condition or decrease of milk flow.

If the farmer will keep these points in mind and select good bulls from good-producing strains, he may be assured of spending his precious food on animals which deserve it and which will, by high and efficient production, repay him for the trouble he has taken in selecting and breeding this type.

Farming in the Sandveld:—

[*Continued from page* 236.

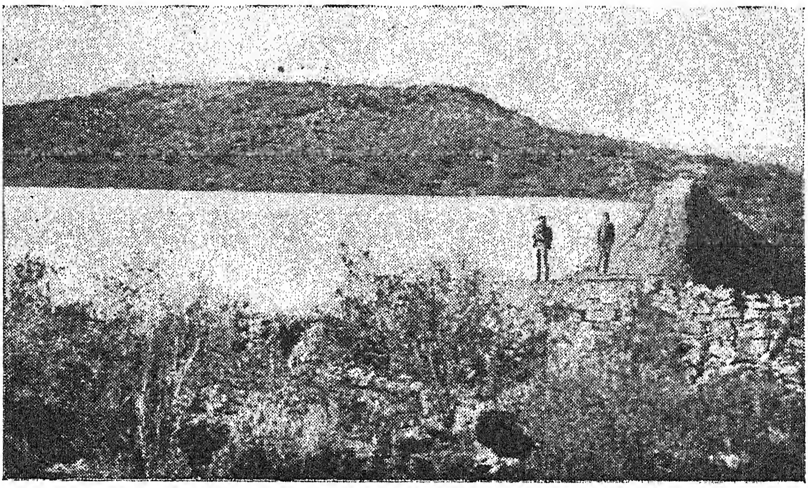
Crops which are hardy and suitable for planting on patches of drift sand are *inter alia*, golden willow (Ac. cyclopis), spurt-grass, and marram-grass. These plants can all be grown from seed, but marram-grass will thrive better if propagated by means of slips. Both spurt-grass and marram-grass grow well in sand and help to bind it. Furthermore, they are eaten by animals, and there is no danger of their overrunning the farm or becoming troublesome weeds.

In conclusion it is suggested that where stock must pass over sandy veld every day on their way to drinking places, and where the danger exists that such veld will be trampled out and so exposed to the drift-sand menace, a definite cattle track should be made and fenced in. This path should not be so wide that the wind will be able to make an impression on it and start blowing the soil away. The objection might be raised that the fencing in of a road is an expensive undertaking, but it is far better to spend money on fencing material than to expose veld to the drift-sand menace which will rapidly transform it into a useless, desert waste.

Farsightedness in Agricultural Production.

J. Joubert, Extension Officer, Ladismith, C.P.

NESTLING at the foot of the Klein Swartberg range is the beautiful little town of Ladismith with its new modern cheese factory, the daily output of which is sufficient to meet the requirements of 10,880 consumers. This is a remarkable achievement for a small district with limited possibilities, where farming is of an extremely diversified nature, and dairy farming forms only one of the various branches. This development, however, rests on a



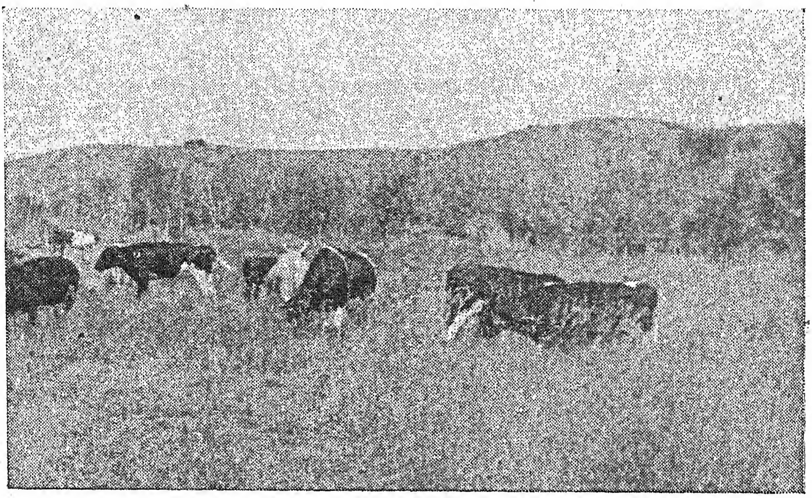
A Soil-Erosion Dam.

foundation which was laid many years ago before a crisis arose, because many years ago the farmers, displaying farsightedness in regard to their herds, registered all their cows under the milk-testing scheme. The effectiveness of this policy is clearly shown by the high level of production of many herds to-day. This district has not yet been declared a cattle-improvement area, the delay being largely due to the good class of bull to be found in this area. In addition, most of these bulls are registered animals.

The Dam-construction Scheme.

Every Karroo farmer realizes the necessity of conserving water and farmers in the Ladismith district have without exception exercised forethought in taking full advantage of the facilities offered under the Government soil-erosion and dam-construction scheme. It is for this reason that the above district was able to break the record for the Union. The intensive construction of dams, especially for impounding the water of small mountain streams and rivers not only benefited farmers individually, but also contributed towards the improvement of the area as a whole. In those areas which are further removed from the perennial mountain streams, farmers are now able to carry on cattle farming on a more extensive scale. Fresh water is now available for watering stock and a greater supply can be used for irrigation purposes. In addition, Ladismith was able to withstand effectively the drought experienced in the Little Karroo last winter.

The expansion of viticulture and fruit-farming in this district has shown the importance of not neglecting cattle farming as a means of maintaining at a high level the soil fertility of the district. As a result of this far-sightedness Ladismith can to-day boast of its beautiful lucerne lands. When a lucerne land begins to deteriorate after a few years, the lucerne may safely be ploughed under and



Grazing in a River bed.

other crops cultivated instead. Consequently, the shortage of fertilizers has not seriously affected this district yet.

In this district where most vines are still grown on domesticated rootstocks, the occurrence of *Phylloxera* is causing anxiety for the future. There is no doubt that the cheese factory was erected with the specific object of bridging a gap, while another important branch of farming, namely, viticulture, was suffering a temporary setback.

The cheese factory also owes its establishment in no small measure to the trust which farmers began to display in the co-operative movement during the past few years. This trust naturally strengthened the hands of the deputation sent to the Dairy Control Board, to whom they could put the prospects of the proposed factory with confidence. Indeed, so great was this confidence of the promoters in the enterprise that the Board could not reject their proposal. The results achieved during the few months of operation have already fully justified the existence of the factory. Consequently, Ladismith can to-day answer the call of the Department for increased food production in a tangible manner.

As for the future, far-sighted measures are being taken now to guard against possible setbacks. There is no longer any room for articles of luxury in the farming system of this district and the reckless speculation of earlier times is a thing of the past. It is sincerely hoped that after the war farming in this district will not experience a recurrence of the disastrous setback, suffered at the time of the collapse of the ostrich-feather market. The demoralizing effect of that disaster left deep traces on the community for a whole generation, and showed the need for greater vigilance.

To-day farming is developing on a sound foundation and along more permanent lines—facts which give cause for greater confidence in the future.

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 MARCH 1943 No. 247

CONTENTS

* Price Review for January, 1943.

SLAUGHTER STOCK.—The seasonal decline in the prices of slaughter cattle which already began in December, continued during January, and the average prices of practically all classes of slaughter cattle were lower in January than for December. Ordinary primes on the Johannesburg market were 62s. 10d. per 100 lb. estimated dressed weight *on the hoof* in January, as against 69s. 4d. the previous month; good mediums were 57s. 2d. as against 64s. 3d. and compounds 47s. 10d. as against 51s. 1d. Slaughter sheep were also fairly heavily supplied with a reasonable quantity of prime lambs. Prices declined until approximately the third week, and thereafter began to rise as a result of more moderate supplies. The average prices realised during January, however, were on the whole, somewhat lower than for December. Prime merinos on the Johannesburg market, e.g., were 11·2d. per lb. estimated dressed weight on the hoof, as against 12·3d. per lb. for December, while prime merinos on the Cape Town market were 10·8d. per lb. as against 10·9d. in December. Prices of pigs changed little or nothing.

Feed.—Exceptionally large quantities lucerne hay came on the markets, but on account of the strong demand resulting from the scarcity of other feedstuffs, prices remained firm everywhere on a high level. Cape lucerne on the Johannesburg market was 5s. per 100 lb. Oat hay was very scarce and teff grass mostly unobtainable, so that good quality of the latter mostly sold at the fixed maximum price.

Potatoes.—Large supplies locally produced potatoes supplemented by consignments Transvaal potatoes caused the supply to exceed the demand by far and coupled with the fact that the quality of a good proportion of the offerings left much to be desired, prices were on the whole on a very much lower level than for the previous month. On the Johannesburg market, e.g., Tvl. No. 1 declined from 11s. 6d. to

* All prices mentioned are average.

7s. 9d. per bag in January and N.M. Grade 1 Nos. 2 and 3 from 14s. 1d. and 13s. 3d .to 10s. 9d. and 10s. 8d. respectively. On the Cape Town market, Cape No. 1 declined from 12s. 2d. to 10s. 9d. per bag, and Natal No. 1 on the Durban market from 15s. 6d. to 14s. 2d.

Onions.—Large supplies of generally good quality were present on the markets during the first half of the month, and prices declined. Towards the end of the month, however, supplies began to dwindle and prices rose. Average prices for the month, however, were lower than for the previous month. Cape onions on the Johannesburg market were 9s. 4d. per bag for January as against 10s. 11d. in December and on the Cape Town Market 7s. 8d. as against 11s. 9d. per bag.

Vegetables.—Vegetables, especially green peas and beans, beetroot and lettuce, were on the whole relatively scarce and realised exceptionally high prices at times. On the Johannesburg and Pretoria markets, consignments pumpkins gradually increased, and towards the end of the month the supply was sometimes far too big and prices declined appreciably.

Tomatoes.—Moderate to good supplies tomatoes were regularly present, and good quality realised exceptionally high prices. N.M. tomatoes on the Johannesburg market were 4s. 11d. per tray and ordinary tomatoes 2s. 4d. per tray, while on the Cape Town and Durban markets the prices were respectively 2s. 6d. and 2s. 8d. per tray.

Fruit.—Consignments deciduous fruit were still by far the most important on the fruit market. Peaches and also plums were the most important kind, while grapes increased sharply, as well as apples and pears. The demand was excellent, but prices on the whole somewhat lower than for the previous month. Oranges were moderately supplied and experienced a sharp demand. Mangoes were in full season and were the most important tropical fruit on the markets. Prices hereof, however, remained firm. Pineapples were also well supplied towards the end of the month, and although the quality sometimes left much to be desired, prices were reasonable. Watermelons and Spaanspeks were very plentiful and prices in general very low.

Eggs and Poultry.—The supply of eggs was small but the demand very good and prices showed a rising tendency. Supplies of poultry were moderate, but because of the fact that the quality was poorer and the demand smaller, prices in general were lower than for December.

Index of Prices of Field Crops and Animal Products.

The only group in this index, as shown elsewhere, which shows an increase is that of hay, which rose from 123 in December to 132 in January, on account of the sharp demand resulting from the scarcity of most feedstuffs.

The most important declines occurred in the case of—

(i) "Other field crops", viz., from 137 to 113 in January, especially as a result of the further sharp decline in the price of potatoes.

(ii) Slaughter stock, which decreased from 178 tot 165 in January as a result of the seasonal decline in the price of slaughter cattle.

(iii) Poultry and poultry products, viz., from 158 in December to 150 in January.

The combined index shows a decrease from 144 in December to 141 in January.

Slaughtering of Cattle at Abattoirs.

IN the table below, the total number of bulls, oxen, cows and calves slaughtered annually at 38 important abattoirs of the Union, are given. These figures were derived from the monthly bulletin of the office of Census and Statistics, and represent between 70 and 80 per cent. of the total slaughterings of cattle at Union abattoirs.

Slaughterings of Cattle at 38 important abattoirs of the Union.

	Bulls.	Oxen.	Cows.	Calves.
1938	7,942	387,339	78,053	53,989
1939	6,317	397,687	73,114	57,213
1940	6,369	444,378	80,015	60,142
1941	7,322	501,264	103,202	71,365
1942	8,191	528,540	123,077	77,939

From the above figures it appears that the numbers of each class of cattle slaughtered increased annually since the outbreak of the War. Of more importance is the percentage increase of each class of cattle slaughtered since 1939. It appears that slaughterings of bulls were 30 per cent. higher in 1942 than in 1939; that of oxen 33 per cent., of calves 36 per cent., while that of cows and heifers increased with 68 per cent.

For purposes of comparison, the following table of slaughterings of cattle in the Argentine, is also published:—

Slaughterings of Cattle in the "Frigorificos" and Liniers Abattoirs.

	Bulls and Oxen.	Cows.	Calves.
Jan.-Aug. 1939	1,853,162	722,547	417,259
Jan.-Aug. 1940	1,705,263	731,580	425,341
Jan.-Aug. 1941	1,921,434	603,998	598,738
Jan.-Aug. 1942	1,782,378	647,935	576,049

Although the above figures do not by far reflect the total slaughterings of cattle in the Argentine, it is sufficient to indicate that where the tendency in the Union is to slaughter greater numbers of cows and heifers, in the Argentine, which is one of the most important export countries of beef, the reverse is the case.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON (1st July to 30th June).	Summer Cereals, (*a*)	Winter Cereals. (*b*)	Hay. (*c*)	Other Field Crops. (*d*)	Pastoral Products. (*e*)	Dairy Products. (*f*)	Slaughter Stock. (*g*)	Poultry and Poultry Products. (*h*)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936-37	118	86	94	93	122	86	89	98	106
1937-38	89	106	112	118	98	112	105	107	101
1938-39	92	107	96	89	79	102	106	94	93
1939-40	86	106	77	93	116	105	106	89	104
1940-41	109	113	106	159	103	108	110	112	109
1941-42	121	132	145	205	101	131	134	163	124
1942—									
January	131	137	126	180	100	122	144	141	125
February	132	138	125	168	101	130	140	147	125
March	126	140	140	175	101	130	134	168	125
April	126	139	151	170	102	130	129	175	125
May	158	139	188	181	102	154	132	203	136
June	159	139	207	186	101	154	140	218	138
July	159	140	183	184	166	167	154	163	143
August	159	139	181	175	115	167	155	130	140
September	159	139	182	191	115	167	176	133	145
October	159	139	156	227	115	167	181	141	147
November	160	154	134	189	115	139	187	146	147
Desember	160	154	123	137	115	139	178	158	144
1943—									
January	160	154	132	113	115	139	165	150	141

(*a*) Maize and kaffircorn.
(*b*) Wheat, oats and rye.
(*c*) Lucerne and teff hay.
(*d*) Potatoes, sweet potatoes, onions and dried beans.
(*e*) Wool, mohair, hides and skins
(*f*) Butterfat, cheese milk and condensing milk.
(*g*) Cattle, sheep and pigs.
(*h*) Fowls, turkeys and eggs.

Index of Prices Paid for Farming Requisites.

Year and Month.	Implements. (*a*)	Fertilizers. (*b*)	Fuel. (*c*)	Bags. (*d*)	Feeding Stuffs. (*e*)	Fencing Material (*f*)	Dipping and Spraying Material. (*g*)	Building Material. (*h*)
Base—								
1936-38	100	100	100	100	100	100	100	100
1939	105	106	98	146	90	114	100	103
1940	120	139	117	171	95	176	112	124
1941	124	170	124	175	109	208	115	144
1942—								
January	121	146	125	188	115	229	117	164
April	122	146	134	194	127	228	117	165
July	124	146	146	220	147	231	118	167
October	124	146	152	224	145	230	118	171
1943—								
January (*j*)	124	146	152	232	144	228	123	173

The following is the composition of the above groups. (The items are weighted according to their respective importance):—

(*a*) Ploughs, planters, seed drills, harrows, cultivators, ridgers, mowers, binders-hay rakes, silage cutters, hammer mills, separators, windmills, shares, land, sides, mouldboards, knife, pitman, guard.
(*b*) Superphosphate, ammonoium sulphate, potash, muriate, bonemeal.
(*c*) Petrol, power paraffin, crude oil, grease, lubricating oil.
(*d*) Woolpacks, grain bags, sail twine, binder twine.
(*e*) Mealies, bran, oats, ucerne, groundnut-oil cake, bonemeal, salt.
(*f*) Fencing wire, standards, baling wire.
(*g*) Bordeau mixture, lime sulphur, arsenate of lead, cyanogas, Cooper's sheep dip, Little's dip, Tixol cattle dip.
(*h*) Corrugated iron, deals, cement, lime, flooring boards.
(*j*) Preliminary.

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Information on Departmental Publications.

Farming in South Africa, the monthly journal of the Department, contains popular as well as scientific articles on a variety of agricultural topics, useful to both the farmer and the housewife, while the **Crops and Markets** Section, supplies information on crop prospects, market prices and exports of agricultural produce.

The following particulars in regard to subscriptions and advertisements should be noted:—

Subscription.—Within the Union, South West Africa, Bechuanaland Protectorate, Southern Rhodesia, Swaziland, Basutoland, Mocambique, Angola, Belgian Congo, and British Territories in Africa 5s. (otherwise 7s. 6d.) per annum, post free, payable in advance.

Applications, with subscriptions, to be sent to the Government Printer, Koch Street, Pretoria.

Advertisements.—*The Tariff for Classified Advertisements is:* 2d. (two pence) a word with a minimum of 5s. per advertisement (prepaid). Repeats, not entailing any change in the wording, will be published at half the cost of the original.

Conditions:—

(1) The advertisement will be classified under specific headings, and only one black letter (initial letter) is permitted.
(2) Advertisements in which prices are mentioned must contain the name and address of the advertiser. A nom-de-plume or box number only is not sufficient, and unless this condition is strictly observed advertisements will not be accepted.
(3) Advertisements will be classified strictly in accordance with the subject-matter of the announcement, determined by the first item mentioned, and cannot be inserted under irrelevant headings.
(4) Displayed, classified advertisements will also be accepted. The charge however, will be 15s. per inch, single column, per insertion, without reduction for repeats

Copy for Advertisements to be in the hands of the Government Printer, Pretoria, not later than the 20th of the month preceding publication.
Send all advertisements direct to the Government Printer, or write to him for details as to tariff for advertisements.

Popular Bulletins.—Bulletins on various agricultural topics are published by the Department to meet public demand. A list of available bulletins giving particulars of cost, etc., is obtainable free of charge from the Editor, Department of Agriculture and Forestry, Pretoria.

Scientific Publications.—From time to time the different Divisions of the Department issue science bulletins incorporating the results of research work conducted by them. Other scientific publications issued are: "The Onderstepoort Journal", "Memoirs of the Botanical Survey of South Africa", "Bothalia", "Entomological Memoirs" and the "Annual Reports of the Low Temperature Research Institute". Information in regard to these publications is obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Press Service.—The Press of South Africa is now supplied with a bulletin of agricultural information for their exclusive use. This information is published fortnightly by all newspapers and other journals throughout the country.

Farmer's Radio Service.—In addition to the printed information supplied by the Department to members of the farming community, the Department, in collaboration with the South African Broadcasting Corporation, also maintains a daily broadcasting service to farmers. Information in regard to times of broadcasting is contained in the programmes issued by the Broadcasting Corporation.

Inquiries.—All general inquiries in regard to the publications of the Department, including the Radio Service, should be addressed to the Editor, Department of Agriculture and Forestry, Pretoria.

D. J. SEYMORE, Editor

FARMING IN SOUTH ... AFRICA

Vol. 18 APRIL 1943 No. 205

Editorial:

Winter Crops in the Summer Rainfall Area.

THE rôle played by winter crops, especially wheat, in the farming systems of the summer-rainfall area has gradually increased in importance. Last year there was an extraordinary expansion in the area sown to wheat. As a result of the prospects of good prices, the effect of the drought on summer crops and the consequent decline in income, and especially the good autumn rains, it is to be expected that winter crops will be sown on an even greater scale this year.

A feature of this development is the fact that the greater the quantity of wheat sown, the smaller is the average yield per morgen. In the case of dryland farming this trend must be ascribed mainly to the fact that wheat is now sown in areas which are wholly unsuited to its production and, in the case of irrigation farming, to the systematic deterioration of soil fertility.

The position, therefore, is that dryland wheat will be sown on a very extensive scale this year, and that unless the season turns out to be extremely abnormal, a very considerable proportion of the crop will never produce a profitable yield. This fact alone is no justification for condemning the expansion of wheat production, because with judicious utilization by way of grazing, the crops can be turned to profitable account even if no grain is produced It is fairly widely asserted that the eventual grain yield of wheat is reduced by grazing. This assumption is subject to considerable qualification, however. If dryland wheat is sown on soil which has been poorly prepared and which contains no moisture reserves, grazing will usually prove detrimental, although the chances of a good grain crop being produced under such circumstances will in any case be remote. On the other hand, if the soil is thoroughly moist to the depth of a foot or more at sowing time and a good stand is obtained, judicious grazing will certainly do no harm and may even improve the chances for a good grain yield.

The requirements for the best results with judicious grazing may be briefly summarized as follows:—

(1) With a good stand of wheat on well-prepared soil and adequate rain during autumn and at the time of sowing, wheat can be profitably grazed until it begins to run or stool, i.e., until the beginning of the piping or jointing stage.

(2) Such grazing does not exhaust the soil moisture and may even have the opposite effect, owing to the fact that the leaf surface and, consequently, the loss of moisture in the case of luxuriantly growing wheat is reduced. Grazing before the piping stage is not detrimental to the eventual grain yield and helps considerably to counteract the tendency in certain varieties, like Scheepers, to lodge. Grazing is most harmful when wheat begins to reach the jointing or early piping stage. Many young culms are then killed by grazing and the shock to the plant is so great that the grain yield is reduced. It is precisely at this stage that farmers sometimes feel that the development of the crop must be retarded until a soaking shower has fallen. Under such circumstances previous grazings have this important

advantage that the plants will be hardier, will absorb less moisture and be better able to resist the shock of grazing.

(3) The best results are obtained by the application of sound systems of rotational grazing and by allowing animals access to the crop only during certain parts of the day. Depending upon soil moisture conditions at sowing time, wheat which is sown in March-April is usually suitable for grazing within 8 weeks. The ideal procedure is to graze the land in sections as uniformly as possible within a short period. Temporary fences to divide off the land into convenient sections would be of great assistance in this connection. Sheep in particular are inclined to graze luxiantly-growing wheat unevenly and to trample it down when the flock has free access to a large land.

Such grazing is undoubtedly of excellent quality. In the case of cattle it means that all cows with a daily production of 3 gallons or less will be able to manage without concentrates, provided they can eat their fill twice daily and are given an adequate quantity of good dry hay. In the case of high-producing animals, the concentrate ration can be cut down by 50 per cent. This is an important consideration, especially in view of the prevailing high prices for protein-rich feeds. It should be borne in mind that wheat pasturage has a protein content of aproximately 5 per cent. on a wet basis, and 20 to 25 per cent. on a dry basis. In addition, wheat pasturage is particularly valuable during that time of the year owing to the succulence which it provides.

(4) In the more favourable and established dryland wheat areas which can count on good rains during spring, it will be advisable to discontinue further grazing of the wheat as soon as it reaches the jointing stage in August. In the less favourable areas, grazing should be continued a little longer in an effort to delay the development of the wheat and to make the best use of the crop. As soon as sufficient rain has fallen, stock should be removed and the crop allowed to develop. In such a case the wheat will produce a reasonable yield and, at the worst, grazing of the crop in the early piping stage will probably reduce the grain yield by about a third. As the chances of getting such opportune rains are very slender in those areas where wheat will be sown this year at a venture, the alternative is not a question of no pasturage and a normal crop, but of additional grazing and the slight possibility of reaping two-thirds of what might normally be expected.

The following varieties of wheat are recommended for the summer-rainfall area. The best grazing is provided by varieties which are sown early, i.e., long-season varieties like Scheepers or Baart Indië and the Red Egyptian types. Rapidly maturing varieties which are sown in May or June develop too poorly to provide pasturage, and are also usually very seriously affected by grazing. For dryland cultivation in the highveld areas of the Orange Free State and Transvaal, the former varieties are, therefore, the most suitable unless the sowing rains arrive very late.

An exceptional case is that of the Springbok Flats where the chances of timely and adequate rains falling during the flowering stage are very remote. On the other hand, however, the soils have a very high water-retaining capacity so that if farmers in this area are willing to risk sowing wheat after the failure of their summer crop, a rapidly maturing variety like Lalkasarwali is the obvious choice. The success of the crop will depend upon the depth to which the soil is moist at sowing time and also on the absence of killing frost when the wheat comes into the ear. In any case, the chances for success are very slight.

[Continued on page 266.

Inspection of Meat on the Farm.

G. C. van Drimmelen, Government Veterinary Officer, Bloemfontein.

IN a thinly populated country like South Africa, with few great cities, large quantities of meat are used which have not previously been inspected and passed by qualified officials. Among primitive races superstition plays an important rôle in determining the suitability of meat for human consumption. The Xosas, for example, are not allowed to eat the beef of cattle which have died until the carcase has been examined by a witch-doctor who determines whether the meat is to be roasted or boiled or not to be touched at all, depending on whether the animal died of gall-sickness or anthrax or was struck by lightning. We all know that in Old-Testament times the pig was avoided as unclean. Apart from religious convictions the ancients probably also knew that pork might be harmful because of the danger of measles.

In our civilization the methods of primitive races have come to be regarded as practices of superstition. We erect abattoirs where animals are slaughtered under supervision and the meat is inspected by experts. In country districts, however, where the majority of our animals are slaughtered, it often happens that this work is assigned to those who are least qualified for the job.

The dangers to health which attend such a procedure must be obvious to everyone and it is therefore imperative that the work should be entrusted to a responsible person whose duty it will be to apply at least the essential principles of meat inspection on the farm.

Transmission of Diseases.

In carrying out such inspections, it should be borne in mind that diseases such as typhoid fever can be transmitted through meat from one person to another; it is also possible that an animal may be a carrier of a disease such as tuberculosis, measles in cattle and pigs and anthrax which may infect a consumer.

People who handle meat and who have previously suffered from typhoid fever, may after their recovery remain carriers of the germ, and so contaminate meat. It is even possible that other human diseases may be similarly spread.

Meat may also become infected with dangerous toxins and germs, as when it becomes contaminated with the stomach contents of an animal suffering from calf paratyphoid. Even slightly decomposed meat may cause fatal poisoning. Infection may also be indirect, as when a human being becomes infested with bladder worms through contact with a dog which in turn suffered from tape-worm infestation through eating contaminated meat.

Attractiveness.

In order to have the maximum beneficial effect on health, food should be fresh, sound and attractive. Meat absorbs dirt so readily that it is practically impossible to clean it by washing. Consequently, contaminated portions are unfit for table use and constitute a loss to the consumer. Meat must, in all circumstances, be kept free from flies and maggots, and can best be preserved in an attractive state by hanging it up in a cool, dry place.

Fortunately, the Department of Public Health and the Division of Veterinary Services are in a position to control the most dangerous diseases by the strict application of regulations. The duty of pro-

tecting the health of consumers, however, rests with the head of each household, who in any case has to bear medical costs and is by law compelled to report suspected cases of infectious disease without delay.

Slaughtering.

It is suggested that in slaughtering animals the following routine procedure be adopted:—

(1) Bring the animal to be slaughtered to a cleaned, prepared site; a room with a cement floor is best fitted for this purpose. Out in the open, a patch of short quick-grass is more suitable than a kraal floor or bare ground. A place for hanging the carcase and organs is a practical necessity, and an abundant supply of hot water must in any case be available.

(2) Make sure that the animal to be killed is in good health. Watch for signs of fever, anaemia, jaundice, weakness, swellings, discharges from the nose, eyes, etc., and excessive movement of the bowels. Animals showing such symptoms should not be slaughtered.

(3) See to it that the animal is killed as humanly as possible. Do not chase or frighten the animal since this will adversely affect the keeping quality of the meat.

(*a*) *Cattle* are usually shot in the fore-head at the crossing of the two lines between the horns and the opposite eyes, the marksman standing directly in front of the animal. In shooting an animal, great care must be exercised; guard against injury by a bullet which glances off the animal's head when fired at a wrong angle, or ricochets after striking a stone or a wall behind the animal. Immediately open the jugular veins.

(*b*) *Pigs* are usually killed by dealing the animal a stunning blow on the forehead and then immediately severing the veins and arteries near the heart to induce thorough bleeding by stabbing it in the throat just below the gullet.

(*c*) *Sheep.*—Cut the throat, severing the spinal chord. Allow to bleed.

(*d*) *Fowls.*—The old method of decapitation is undesirable. Rather use a knife with a small strong blade, proceeding as follows:—Suspend the bird head downwards and puncture the brain by sticking the knife through the palate; then turn the knife, cutting edge upwards, and thrust the blade obliquely into the throat, opening the jugular veins. Allow bleeding through the beak.

N.B.—(i) In order to retain the keeping quality of meat, all slaughtered animals must be thoroughly bled.

(ii) Inspect the carcase externally and remove all soiled or undesirable parts.

(iii) Slaughterers must be clean and their hands well washed; clean clothes and a head covering are very necessary.

(iv) Slaughtering knives which become contaminated with dirt, dung or pus, must be washed and immediately sterilized by boiling before being used again.

(4) Flaying is effected as follows:—

(*a*) *Cattle carcase.*—The hide is removed by flaying. As far as possible, avoid cutting into the muscles or white subcutaneous connective tissue over the meat which forms a protective surface.

(*b*) A pig carcase must be placed in boiling water and the hair removed.

(*c*) Sheep, etc. The same as for cattle.

(*d*) Fowls, etc. The best method is dry plucking immediately after the bird has been killed. A small tin for collecting the blood may be suspended from the head of the bird by means of a nail hook attached to the skin of the throat, in order to avoid soiling the clothes of operators.

(5) Opening of body cavities. Organs should be removed without contaminating the rest of the carcase. The whole body, except the intestines, should preferably be hung. The carcase is then washed with hot water and clean, boiled towels.

(6) For inspection of the carcase, use a clean sterilized boiled knife.

Inspection.

In carrying out inspection, the aim is first to discriminate between meat which is either dangerous or unattractive and meat which is good and sound. Economic considerations are, of course, always borne in mind. It is e.g. recommended that carcases infected with tuberculosis and calf paratyphoid should be entirely destroyed. Carcases infected with measles, gallsickness, etc., may be boiled down and then used for soapmaking or ground for stock feed; parts of carcases infested with bladder worms such as those which produce echinoccus abscesses, etc., should rather be burnt.

Very useful hints on the inspection of meat can be obtained by consulting a Government Veterinary Officer and visiting large abattoirs. Departmental publications contain information on measles, tuberculosis, echinococcus, bladder worms, anthrax, calf paratyphoid, Johne's disease, East Coast fever, liver fluke and liver tapeworms, pneumonia, arsenical poisoning and necrobacillosis.

Measles in animals represent the early stages of tape worm in human beings. They appear in the form of small cysts filled with a clear fluid in which the head of the future tapeworm swims about as a small, white nodule. If some of the measles are dead and calcified, it does not mean that the carcase is suitable for consumption, since others may still be alive and able to spread the infection. Unless the carcase has been inspected by an expert or freezing treatment has been applied, the whole of the carcase must be rejected.

Tubercular abscesses are often filled with a cheesy substance having a granular texture not unlike grains of sand in clay, when rubbed between the fingers.

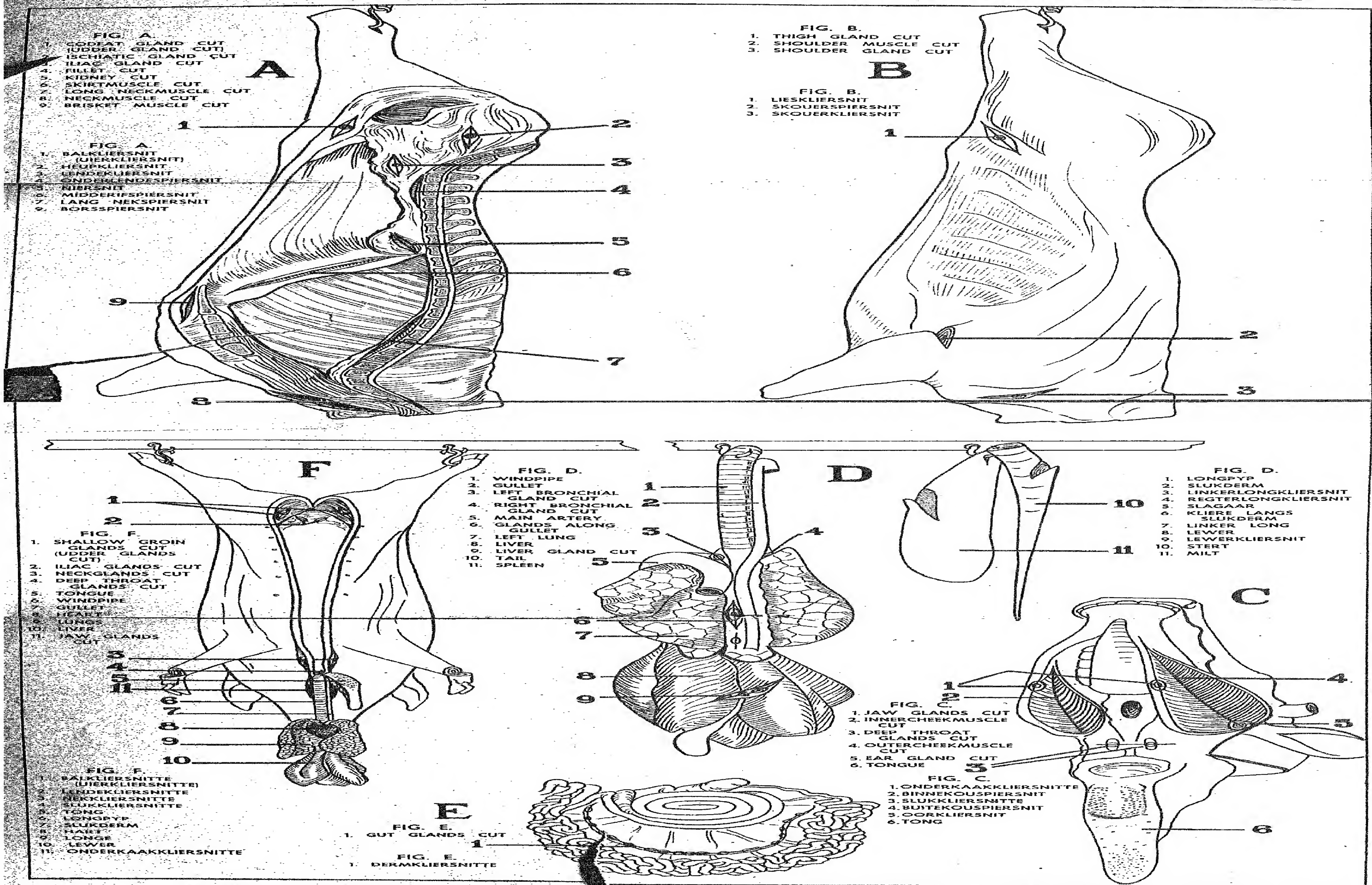
Typical of these abscesses is the formation of connective tissue. Small abscesses on being cut invariably show a whitish yellow colour, not green as is often the case with worm nodules. Unless the carcase is examined and is passed by an expert, it must be entirely rejected.

Liver disease or calf paratyphoid is caused by a bacillus which is capable of directly infecting a human being. The bacilli may also multiply in the meat where they form toxins which may be very harmful to the consumer.

Echinococcus bladder worms are dangerous to those who handle meat, since they may be full of daughter bladders which may lead to infestation through the eyes or mouth, quite apart from the infestation caused in human beings by eggs passing from the animal body in the excreta or clinging to the hair or tongue of a dog suffering from this type of tapeworm.

Ptomaines.—These toxins develop in decomposing meat from about the fifth or sixth day even if the meat is free from disease organisms.

PARTS OF CARCASE WHICH MUST BE EXAMINED DURING THE INSPECTION OF MEAT
KARKASDELE WAT ONDERSOEK MOET WORD BY DIE KEURING VAN VLEIS



SEE BACK FOR SUMMARY OF DISEASES

SIEN AGTEROP VIR OPGAWES VAN SIEKTES

Strychnine is much less poisonous to poultry than to human beings, and the meat of birds which have eaten this poison without serious consequences to themselves, may prove fatal to human beings.

The Value of Good Seed.

SUMMARY OF DISEASES WHICH MAY BE PRESENT WHEN MEAT IS INSPECTED.

Organ.	Lesions.				Inspection.
	Cattle.	Pigs.	Sheep.	Other.	
Lungs.—Cut glands at windpipes (Fig. D: 3 and 4) and palpate tissues, cut glands along gullet (Fig. D: 6)	Bladderworms Abscesses Inflammation	Bladderworms Abscesses Inflammation	Bladderworms Abscesses Inflammation	Bladderworms Abscesses Inflammation	Cut out if local and not excessive—otherwise destroy lungs completely. Same. *Tubercular* abscesses; destroy whole carcase. In case of septic or rotting lungs, and also *tubercular* ulcers or growths, destroy whole carcase. If lesions local, cut out.
Heart.—Open pericardium and examine whole surface; cut into muscle if change is perceptible	Endocarditis Measles	Endocarditis Measles	Endocarditis —	Endocarditis —	If localized and of long standing, cut out. If septic, destroy carcase. *Measles.*—Destroy carcase or convert into soap, stock feed, etc.
Liver.—Cut gland at bile duct and make deep transverse incision; express contents from ducts and examine surface (Fig. D: 9)	Abscesses Bladderworms Liver-fluke Tapeworms Stringy Fatty degeneration Jaundice	Abscesses Bladderworms Liver-fluke Tapeworms — Fatty degeneration —	Abscesses Bladderworms Liver-fluke Tapeworms — Fatty degeneration —	Abscesses Bladderworms Liver-fluke Tapeworms Stringy Fatty degeneration Jaundice	If localized, cut out, but if diffuse and numerous, destroy liver. In case of *avian tuberculosis*, destroy carcase. If local, cut out; if diffuse, destroy organ. Unsuitable for human consumption. Destroy if far advanced, otherwise edible. (Discover cause.) Destroy carcase in case of *calf paratyphoid, fowl typhoid*, and unknown causes. Convert into stock feed in case of tick gallsickness, geilsiekte and simple obstruction.
Gullet.—Clean and examine muscle	Measles	Measles	—	—	For *measles* in cattle and sheep, see above. For *bladderworms* in other animals cut out and destroy.
Spleen.—Cut, examine and palpate tissues (Fig. D: 11)	Abscesses	Abscesses	Abscesses	Abscesses	Destroy, whole or part, according to distribution.
Tail.—Cut glands (Fig. D: 10)	Measles	Measles	—	—	For *measles*, see above.
Stomach and *Intestines.*—Examine fat and stomach membrane (peritoneum), palpate and cut all lymphatic glands	Peritonitis Fatty degeneration Worm nodules Thickening of mucous membrane	Peritonitis Fatty degeneration Worm nodules —	Peritonitis Fatty degeneration Worm nodules —	Peritonitis Fatty degeneration Worm nodules —	If limited and local, cut out. If general, destroy carcase. Remove and destroy affected parts. Same. Discover cause. Remove affected parts (Johne's disease).
Also cut if appearance unhealthy	Erosions in abomasum. —	— Ulcers in gut	— —	— —	Discover cause. Destroy carcase if generally diseased. (East Coast Fever.) Discover cause. Destroy carcase of pig. (Swine paratyphoid.)
Cut open lymphatic glands all along gut	Inflammation in glands.	Inflammation in glands.	Inflammation in glands.	Inflammation in glands.	If local, cut out. If symptoms of *tuberculosis* or general disease, destroy carcase.
Scalp.—Examine for injuries, ulcers, maggots in sawn-off horns, and ulcers due to ticks in ears	Purulent swelling of jaw Sores due to maggots, etc.	— Sores due to maggots, etc.	— Sores due to maggots, etc.	— Sores due to maggots, etc.	Destroy affected part. (*Actinomycosis.*) Same.
Tongue.—Examine for injuries, ulcers etc. Palpate tissues	Measles Purulent swelling of tongue	Measles —	— —	— —	For *measles*, see above. Destroy affected part. (*Actinobacillosis.*)
Cheek muscles.—Double incision in case of cattle. (Fig. C: 2 and 4)	Measles	—	—	—	For *measles*, see above.
Lymphatic glands.—Cut tongue, deep throat glands and ear glands (Fig. C: 3 and 5)	Inflammation	Inflammation	Inflammation	Inflammation	Destroy abscesses. If tubercular, destroy carcase. If bloody or septic, destroy carcase.
Uterus, bladder, urinary tubules, penis, etc., etc., udder scrotum	Inflammation	Inflammation	Inflammation	Inflammation	Cut out and destroy if local and isolated. If septic and glands affected, or other general symptoms, destroy whole carcase.
Carcase.—(Cattle: split by sawing.) Examine and palpate surface. Examine and palpate pleura	Worm nodules Injuries, ulcers, abscesses	Worm nodules Injuries, ulcers, abscesses	Worm nodules Injuries, ulcers, abscesses	Worm nodules Injuries, ulcers, abscesses	Cut out and destroy affected parts. Cut out and destroy if local. If tubercular, destroy whole carcase.
Make long incisions in muscle of midriff, as well as in fillet, neck, shoulder and brisket muscles in case of cattle. (Fig. A: 4, 6, 7, 8 and 9); on inside of thigh in case of pigs	Inflammation Measles	Inflammation Measles	Inflammation —	Inflammation —	Same. For *measles*, see above.
Incise iliac, udder and cod-fat glands, and palpate or cut shoulder and thigh glands. (Fig. A: 1, 2 and 3; Fig. B: 1 and 3)	Inflammation. Abscesses	Inflammation Abscesses	Inflammation Abscesses	Inflammation Abscesses	Cut out and destroy if local. If *tubercular*, destroy carcase. Same.
Palpate kidneys and examine split vertebrae	Abscesses	Abscesses	Abscesses	Abscesses	Same.

SEE BACK FOR SUMMARY OF DISEASES.

Strychnine is much less poisonous to poultry than to human beings, and the meat of birds which have eaten this poison without serious consequences to themselves, may prove fatal to human beings.

Arsenic, if ingested by an animal shortly before it is slaughtered, may occur in the carcase in harmful quantities. In such circumstances it is especially dangerous to eat the liver.

Rejection of Carcases.

The foregoing paragraphs do not contain an exhaustive summary of the many conditions in which the meat of a carcase may be unfit for human consumption. Broadly speaking, *any deviation from the ordinary sound appearance should therefore be regarded with suspicion. All carcases should be examined with due regard to the following general principles*:—

(*a*) Whenever any inflammatory conditions from whatever cause has resulted in general changes in the carcase, the entire carcase must be regarded as unsuitable for use and should be buried. The symptoms are as follows:—

Inflammation of the intestines or guts: bloody intestine and stomach wall.
Diarrhoea in calves: bloody intestine and stomach wall.
Dysentery: bloody intestine and stomach wall.
Peritonitis: bleeding and bloody water in stomach cavity.
Omphalitis: bloodiness around the naval and in the intestine.
Arthritis: swollen, purulent joints.
Uteritis: swollen uterus with purulent discharge.
Nephritis: kidney and surrounding tissues bloody and swollen.
Ulcerated pericardium: purulent and distended pericardium.
Pleurisy: bleeding and water in thorax.
Pneumonia: diffused bleedings, swollen lymphatic glands.

In cases where the inflammation is of a local nature, the affected parts must be rejected. The knife used for cutting through such parts must be sterilized by boiling.

(*b*) If circumstances necessitate the slaughtering of animals in poor condition, the meat must be regarded as unfit if it is (i) loose, soft or watery, (ii) of a reddish-grey colour or (iii) if it shows poorly developed muscles, or (iv) if the kidneys show signs of oedema (water) or haemorrhage.

(*c*) Changes affecting the keeping quality of meat, such as bruises, gangrene, a urine smell, jaundice, discolouration of bone, oedema and anaemia are dangerous because toxins develop very rapidly in such meat, thereby rendering parts of carcases or even whole carcases unfit for consumption.

N.B.—The yellow colour in the fat of stock running on young green veld is harmless. This condition of the fat can usually be distinguished from jaundice by hanging the meat for 24 hours, after which period the colour of the fat will not have become darker as in diseased meat; it may even become lighter.

(*d*) Unsound parts such as abscesses should be cut out together with the surrounding tissue, so that only healthy meat remains.

Since systematic investigation cannot be carried out unless the investigator has had long training, the attached table and drawing

[*Continued on page* 274.

The Value of Good Seed.

Dr. J. H. Hofmeyr, Department of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

ALMOST all our cultivated crops have been developed as a result of seed improvement—a process which in some cases extended over centuries. Our present knowledge of genetics has, however, resulted in a very rapid improvement of crops, especially during the last few decades, so that annually new and improved strains are made available which far surpass the old varieties in yield, resistance to diseases and pests and also in quality. For best results, it is, therefore, necessary to keep good seed pure and not to mix it with that of inferior varieties or strains. Too often our farmers are inclined to class all wheat or maize varieties under one head as just wheat or just maize; they do not appear to realize the importance of such requirements as the *suitability of variety* for a certain locality, and even such factors as the *quality* of the seed used are in many cases disregarded.

The most economic methods of production demand the use of not only the best varieties of the various crops for cultivation but also seed of the very best quality, since the seed sown or planted is the nucleus of the new crop. If this crop is poor, the result will be disappointing. The writer's attention has often been drawn to the fact that farmers in some areas use the poorest quality grain—at times even undergrade—for seed. This practice cannot be too strongly condemned, since such grain is wholly unsuitable for seed purposes. Every farmer selects the best of his animals for breeding, and for the same reasons only the best grain should be used for seed. No farmer has any excuse to remain in the dark as regards the most suitable varieties of the various crops which are grown in his area, since the extension services of the Department of Agriculture and Forestry (which control the various colleges of agriculture each of which serves a definite area) are at his disposal.

Quality of Seed.

As regards the quality of seed, the following characters and factors should be taken into account:—

Germinative power.—The seed must, in addition to being capable of germination, also show a high degree of vitality, otherwise the young seedlings will not be resistant to unfavourable conditions. After a number of years the germinative power of most of our agricultural crop seeds diminishes, and in these circumstances it is not desirable to sow old seed or seed of doubtful quality before testing its germinating power. A germination test can easily be carried out in sand or on blotting paper, etc., if it is borne in mind that the main requirements of germination are: sufficient moisture, sufficient heat and oxygen (enough fresh air). The excessive use of certain chemicals, such as carbon bisulphide, for the control of weevils and grain moths is liable to damage the germinative power of the seed. The moistening of grain with the resultant spontaneous generation of heat may naturally entirely destroy its germinating power.

Size and Development.

Within the limits of the variety, the seed should be full and well-developed, since size is an indication of the quantity of reserve feed available to the germinating seedling. Moreover, it is a sign

of the maturity of the seed. In the case of winter cereals, a high bushel weight indicates good size and development of the seed.

Uniformity.—If seed consists partly of well-developed and partly of small, poor kernels, some of the seedlings will be strong and others weak and small. The stronger seedlings will oust the smaller ones, thus causing a thinner or irregular stand—the first sign of a correspondingly decreased yield. Moreover, the weaker seedlings may be more subject to damage by disease and insects. In the case of crops with large seeds such as maize, beans etc., it is important that the seeds should be of uniform size in order to ensure regular spacing by the planter.

Pure and Sound Seed.

Purity.—In regard to purity of seed, many farmers are still very negligent. Seed is often a means of spreading weeds, especially in the case of fine-seeded crops. In other cases, seed is often impure because of the presence of the seed of related crops or even seeds of other varieties of the same species. Farmers must guard against impurity in whatever form it may occur, and even though they generally realize the undesirability of the presence of weed seed and what it entails, they should be even more scrupulously careful in this respect. The seed of other grain crops, even though related, must also be eliminated. In this connection mention may be made of the occurrence of two-row barley seed in wheat, which is not uncommon in the western Cape Province. In grading cereals, these factors are all taken into account. If, therefore, the seed is not free from all impurities the crop will be affected and consequently the grain will be classed in a lower grade and sold at a lower price than would have been the case if the necessary precautions had been taken.

Even the presence of seed of other varieties of the same species is often disadvantageous, since this factor also counts in the grading of grain. This type of impurity is often the cause of lower yields per morgen due to the lower productivity and poorer resistance against disease which are features of some of the varieties present in the seed.

Another cause of seed impurity which does not generally receive the attention it should, is the fact that many of our agricultural crops are fertilized by cross-pollination, which means that the cultivation of two or more of such varieties on neighbouring or adjacent lands may lead to hybridization. In this way a species may lose many of its popular and most valuable characteristics. Typical examples are rye among winter cereals and maize among summer cereals. Wheat, oats and barley are self-fertilizing, but cross-fertilization is not excluded hence it is possible, even when strict precautions are taken, to have " foreigners " on a land, if a different variety is grown on adjacent land. The danger of cross-fertilization thus makes it imperative that for seed-production purposes, the several varieties of the same species should be grown on properly isolated lands away from one another.

Diseases.—Many of the diseases which affect our agricultural crops and annually cause high losses not only in the form of reduced yields but also as a result of degrading, are often transmitted by seed. Such diseases can be easily controlled simply by properly disinfecting the seed. It should, however, be remembered that all diseases cannot be controlled in this manner and that in this, as well as other respects a well-designed system of rotational cropping should always receive attention.

[*Continued on page* 270.

Kale.

Dr. P. D. Henning, Senior Lecturer in Agronomy,
Stellenbosch-Elsenburg College of Agriculture.

KALE, a member of the *brassica* or cabbage group, thrives best under cool and relatively moist conditions. The crop can be grown on a variety of soils but answers best on a somewhat heavy type. In the winter-rainfall area kale is produced mainly under dry-land conditions. In areas enjoying a relatively high rainfall it can

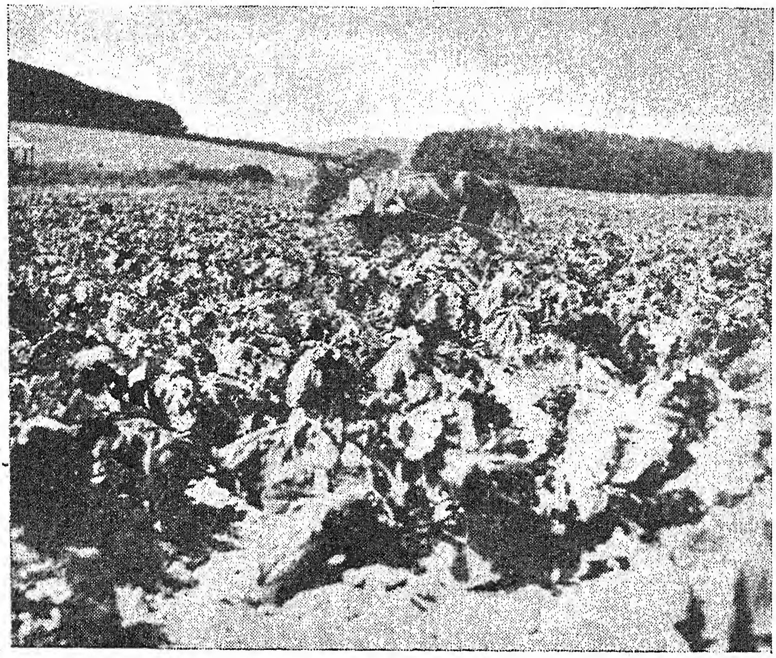


Fig. 1.—A patch of kale.

be successfully grown on high-lying ground, but if the crop has to stand through the summer in the drier areas, such as the Swartland, it should be planted in lower-lying deep soil. Kale is a very valuable fodder crop. With the exception of lucerne no other crop can supply green feed over so long a period of the year. In addition, the plant has a very high nutritive value, and as a succulent feed for milk-producing animals it cannot be surpassed.

Seed Beds.

Kale should first be sown in beds and subsequently be transplanted. For the seedbeds, a plot of fertile soil is selected near water. About 6 to 8 weeks prior to the sowing of the seed two bushel baskets of rotted stable manure together with ½ lb. superphosphate are applied to every 10 sq. yds and dug into the soil. As soon as the manure is well rotted the soil is dug over shallow, and beds made 3½ ft. wide with paths 1 ft. wide between them. Since the plants are generally grown during the winter months, it is advisable to raise the level of the beds a little so that excess water can drain off. This can be effected by working soil from the paths on to the beds. As soon as all the beds have been completed,the seed is sown in rows or drills 6 in.

apart and about 1 in. deep. The rows can be drawn with the back of a rake handle or by means of a notched plank made like a rake with 6 teeth 6 in. apart. With the latter contrivance it is possible to make 6 furrows on the bed simultaneously. It is most desirable to sow the seed in rows as this facilitates weed control and the cultivation and aeration of the soil between the rows. If the weather is hot and dry when the seed is sown, the seed beds can be lightly covered with straw or something similar which must be removed as soon as the seedlings begin to appear. If earth fleas are troublesome, the beds can be treated with nicotine dust. For leaf-eating pests such as caterpillars, the plants should be dusted with arsenate of lead or arsenate of soda.

If the above directions are followed, about 8 oz. of seed will be required for a bed 25 yds long. Such a bed will yield enough seedlings to plant at least one morgen with a spacing of 3′ by 3′. The seedlings are fit for transplanting about 8-10 weeks after the seed is sown, i.e. when they are about 6 in. high.

Before the seedlings are transplanted, the land must be well prepared and fertilized. Since kale is produced as a green feed, a heavier fertilizer treatment is necessary than in the case of winter cereals. An application of 800 to 1000 lb. per morgen of *mixture F* is recommended. If stable manure is available 10 to 15 tons may be applied together with 600 lb. of *mixture F*.

Transplanting.

Kale should be planted in rows with a espacement of 3′ by 3′. In drier areas the plants may be spaced even wider. If the soil is on the dry side, a cup of water to each transplanted seedling will greatly assist the plant to take and so ensure a good stand. The best time for planting kale is from the beginning of July to August. The drier the area, the earlier the planting should be. If irrigation water is available, planting may be carried out as late as October. Kale planted at this time of the year will stand until September of the following year. If succulent feed is needed for the spring months, or if kale is grown specially for ensiling purposes, the seedlings should be transplanted in May. Such plants cannot be left until the following year, since they usually run to seed by October or November. After the seedlings have been planted, the crop should be cultivated at regular intervals, in order to keep down weeds.

Kale planted in July-August produces large and regular yields of green material from September to December. With the advent of warm weather, however, the plant is retarded in its growth and is subject to severe cabbage-moth infestation.

Consequently, kale cannot be relied upon as a source of green feed from the beginning of January until the end of March. With the approach of cooler weather in April, especially after a rain, the kale begins to grow vigorously, and continues to do so throughout the winter until September, when the plants run to seed. At this stage the plants should be cut down and finely sliced for fodder or silage. The application of *mixture F* at the rate of 300 lb. per morgen after the first good rains in April is recommended. The fertilizer should be worked in with a cultivator. At this time of the year green feed is scarce and since this period usually coincides with the lambing season, this green feed is of great value to the farmer.

Harvesting of Kale.

Kale is harvested by picking off the leaves. If the plants are in full growth the process can be repeated every 3 to 4 weeks. It is

important that the stripping should never be too severe. The practice of denuding the plant of practically all its leaves has a very harmful effect on both its vigour and yield.

Table I reflects the yields obtained in an experiment carried out on dry land on a series of adjacent plots. In this trial some plots were severely stripped and others only moderately. The plots with corresponding number were adjacent to each other.

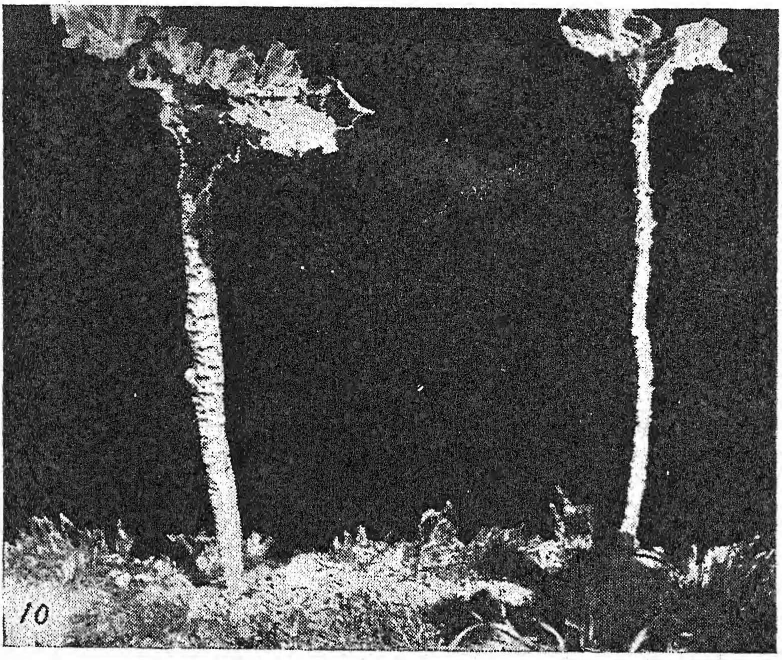


Fig. 2.—*Left:* A moderately stripped plant: *Right:* A severely-stripped plant. (Note how much more delicate and weaker the latter is.)

TABLE I.—*Comparative yields in lb. from severely and moderately stripped plots.*

Plot No.	Severely Stripped.	Plot No.	Severely Stripped.
1	495 lb.	1	850 lb.
2	496 lb.	2	921 lb.
3	433 lb.	3	865 lb.
4	544 lb.	4	820 lb.
5	421 lb.	5	699 lb.
6	391 lb.	6	549 lb.
7	486 lb.	7	713 lb.
8	625 lb.	8	730 lb.
9	498 lb.	9	641 lb.
10	565 lb.	10	754 lb.
11	512 lb.	11	708 lb.
12	558 lb.	12	885 lb.
13	616 lb.	13	799 lb.
14	473 lb.	14	806 lb.
15	513 lb.	15	870 lb.
AVERAGE	508	AVERAGE	750

In the case of the plots which were severely stripped, all well-developed leaves were regularly removed, i.e., to more or less the same extent as occurs on most farms. In the case of those plots which were stripped to a moderate extent, at least three fairly well-developed leaves were left on the plants. According to Table I the moderately-stripped plots yielded on an average 53 per cent. more green feed per year than those which were severely stripped. Expressed in weight the yields were 23 and 15 tons respectively. Moreover, by the end of the season the plants on the severely-stripped plots were much weaker and less well-developed than the other. The above results admit of no other conclusion than that it is extremely detrimental to strip kale too severely.

Feeding Kale.

As has been stated, kale is a very valuable succulent feed for dairy cows, but if fed injudiciously, it may impart a taint to the milk. This difficulty can be completely avoided by keeping the feed out of the byre during milking time and by feeding it only after the milking is completed. Any surplus kale may be successfully ensiled.

Varieties.

Two varieties are in cultivation, namely Chou Moellier and "Thousand Headed". The former can be recognized by its fleshy stem and by the fact that only one large leaf develops from each eye on the stem. The stem of Thousand Headed is thinner, less fleshy and more woody; another feature of this variety is the development from each eye on the stem of a stalk carrying a number of leaves. Chou Moellier should be given preference.

At present good seed is scarce. The quality of much of the seed at present available is unreliable, for the seed often produces bolters which are not profitable to grow. This question has already received attention and efforts are being made to produce good seed locally.

Since kale is such a valuable fodder plant the seed should be used sparingly and with discretion. Furthermore, farmers are advised not to sow seed directly on the land as this causes considerable wastage since more seed is used than is necessary. Farmers who have more seedlings than they require should place the surplus at the disposal of their less fortunate neighbours. As kale seed retains its viability for a long time, farmers who have quantities of old seed at their disposal can make good use of it. In order to make quite certain, however, that the seed is still viable, it should first be subjected to a germination test. This is done by keeping some 100 seed between two sheets of moist blotting paper for about a week. During this period the viable seeds will germinate and the farmer can then decide whether the seed is still worth sowing.

See also articles on "Fodder conservation" in the March issue.

Nursery Quarantines.

The following nursery quarantines were in force on 1st March, 1943:—

1. Page's Nurseries, Franschhoek, C.P., on citrus (all), for red scale.

2. Stuber, C., Mowbray, C.P., on palms (part), for circular purple and silvaticus scales; on strelitzias, for circular purple scale, and on araucarias, for araucaria scale.

Citrus Nematode Investigations.

F. J. Stofberg and J. C. le Roux, Subtropical Horticultural Research Station, Nelspruit.

THE citrus nematode, *Tylenchulus semipenetrans*, Cobb., a parasite on citrus roots, was first reported upon in 1913 by Thomas(1), who states that it was observed in California by J. R. Hodges in 1912. Cobbs(2)(3) after naming this nematode and determining its life history, reported that it had been found on citrus roots from Alabama, Florida, Spain, Malta, Palestine, Australia and South America. Later it was also reported from Algeria en Brazil. Lounsbury (4) first reported it from the Union of South Africa in 1925, and in 1935 Li(5) reported it from South China.

Thomas(6) described the appearance of infested trees in the field as looking undernourished, leaves small, slightly yellow or mottled, fruit small and often unmarketable, while the whole tree appeared stunted and showed a marked state of deterioration.

The conclusions of Byars(7) and Li(5) as regards the appearance of infested trees differ somewhat from that of Thomas, in that they state that the above-ground parts of infested trees show no definite symptoms which could be used as reliable clues for the occurrence of the nematodes on the roots.

As described by Thomas(6) the nematode only partially penetrates the feeding roots of citrus trees, but there is no definite means of determining its presence, except by microscopic examination.

It differs from the root-knot nematode, *Heterodera marioni*, Cornu., in that it does not cause any visible thickening of the roots. Moreover, the latter attacks a great variety of vegetable and commercial crops, while *T. semipenetrans* attacks citrus only.

Fawcett(8), Webber(9) and other authorities are all agreed that the nematode feeding on citrus roots in large numbers undoubtedly causes injury to the tree, but with good cultivation and fertilizer practices, the trees can be kept healthy and at a high level of productivity in spite of its attack.

Purpose of Investigation.

When the problem of greening* of citrus fruits came to the fore, it was decided to make a survey of the citrus nematode, which was found to be present in large numbers in citrus soils. Since it was considered possible that heavy infestations of this nematode might affect tree vigour and might be the cause of greening, this survey was undertaken in order to determine whether there was any correlation between nematode incidence and the amount of greening.

The warm water-funnel method of nematode " extraction " from root and soil samples used throughout this work, was that of Baermann as described by Goodey(10). In this connection valuable assistance was given by Dr. van der Linde of Pretoria University, to whom we are indebted.

General Survey for Citrus Nematode.

A total of 720 bearing citrus trees of different ages, budded on rough lemon stocks, but growing in varying types of soil, in different citrus areas, were investigated. Samples containing feeding roots and ajoining soil were taken, " extracted " and microscopically examined. The survey was carried out in the following areas:—

Eastern Transvaal (greening severe):— No correlation was found to exist between nematode incidence and greening. The parasites

were found to be present in the roots and soil of practically all trees, whether they showed greening or not. Furthermore, non-infested trees did show greening.

Northern Transvaal (greening very slight):— Nematodes were found throughout this area, and no correlation was found between greening and the presence of these parasites.

Western Transvaal (greening present in certain orchards):— No correlation was found between greening and the incidence of nematodes.

Eastern Cape Province (greening absent):— This area, represented by the Kat River, Sundays River and Gamtoos River valleys and the Grahamstown-Bathurst section, was surveyed and citrus nematodes were found to be present in all the orchards examined, even in the most " brak " citrus soils.

From the survey in general, it was noted that the citrus nematode does not seem to prefer any specific type of soil, heavy and clayey types being as heavily infested as the lighter loamy and sandy types. Heavy infestations of the nematode were found on normal healthy trees as well as on unhealthy-looking trees, suffering from lack of vigour, leaf mottling and other maladies.

The authors' conclusion is in agreement with that of Syars(7) and Li(5) namely that the aerial parts of the trees give no definite indication that they are infested with the nematode. Furthermore, greening does not appear to be caused by citrus nematodes.

Although the preliminary findings of this survey do not indicate any correlation, it was considered necessary to conduct further trials to obtain more definite information on the effect of the nematode on citrus trees. These trials and treatmetns are summarized as follows:—

Trial 1. A number of clean and infested Valencia trees, budded on rough lemon stocks, were planted out in three different localities representing different types of soil and climate. At regular intervals of time, large numbers of citrus nematodes suspended in water, were introduced into the root zone of certain of these trees. This was done by drilling a number of holes in the soil about the trees by means of a thick wire, and pouring the suspended nematodes into the holes. The remaining trees were kept nematode-free. These treatments were maintained and the trees kept under observation for a period of four years.

Trial 2.—Sixteen non-infested Valencia trees (also on rough lemon stock) were planted in 40-gallon drums, half the number of trees in nematode-free White River soil and the other half in nematode-free Nelspruit soil. Of this lot, four trees in the White River soil and four trees in the Nelspruit soil were artificially and heavily infested with citrus nematodes (in the same manner as described above), while the remainder was kept nematode-free. This planting was duplicated at White River and Nelspruit, and the trees were under observation for three years.

In these two experiments, it was noted that greening was equally bad on both nematode-infested and non-infested trees. These results, together with the information obtained from the survey, show that the malady called greening, as occurring in the Eastern Transvaal, is not caused by the presence of citrus nematodes.

No efficient method is known for the control of the nematodes in citrus orchards, but in agreement with the concensus of opinion overseas, the authors find that a sound fertilization and cultivation practice

 [*Continued on page* 280.

Rhode Island Red Fowls.

P. H. C. du Plessis, Lecturer in Poultry, College of Agriculture, Glen.

IN Rhode Island, off the east coast of the United States of America, was developed that breed of fowl which has made the name of the island world-famous. According to records, this breed was known as long ago as 1830, and was developed as a farm bird. It is well adapted to conditions prevailing in its country of origin. Various breeds were blended to produce the R.I.R., chief among them being undoubtedly

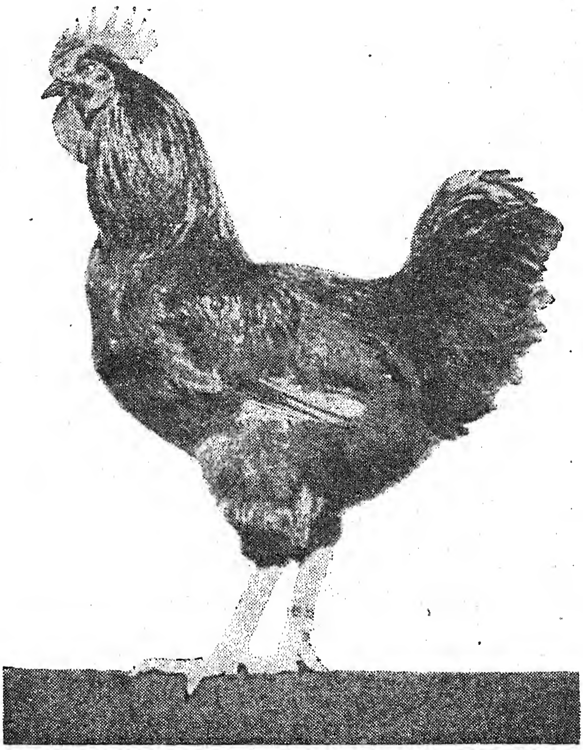


FIG. 1.—This cockerel gained first prize in the open section at the Cockerel Show at Bloemfontein this year. Note his long, straight back and brick-formed body.

the Indian Red Game, the Brown Leghorn and the Wyandotte. Some authorities maintain that the Buff Orpington also played a leading rôle in this matter.

Economic Characteristics.

Of late this breed has become very popular and on many farms large flocks are to be found. In some areas even long established flocks of Leghorns and Australorps have had to make way for this breed. The Rhode Island Red is a dual-purpose breed, i.e., it is a good laying as well as a table bird. In cases where the necessary attention had been given to breeding, the egg-production of the Rhode Island Red compared very favourably with the records established by Leghorns and Australorps at our egg-laying competitions. This is

borne out by the following figures which reflect the results obtained at one of our departmental egg-laying competitions:—

Average Production of A Eggs (i.e., eggs weighing 2 oz. and more).

Period	R.I.R.	Leghorn	Austrolorp
1938–1939...	196·3	193·0	181·4
1939–1940...	182·7	183·6	180·6
1940–1941...	163·3	175·5	171·5

From this table it appears that the R.I.R. established the highest average record during 1938-39. Even the Leghorn, which is known primarily as a good layer, could not equal this record. The R.I.R. figures for 1939-40 and 1940-41 also compare very favourably with those of the other breeds. It is interesting to note, also, that the number of R.I.R. birds entered for our competitions has increased: viz., from 30 during 1938-39 to 90 for 1942-43.

The R.I.R. is one of the breeds which conforms very well to the general economic requirements of the poultry industry. In addition to its high egg-producing capacity, it also possesses outstanding meat qualities. Moreover, the bird attains a good table weight and its dressed carcass has a very attractive appearance. Old hens as well as cockerels are disposed of at remunerative prices. The R.I.R. is one of the breeds used for crossing with a view to producing table birds. The disadvantage of black pin-feathers, characteristic of the black Australorps, is absent in the R.I.R. The oversea market, particularly the English market, objects to the yellow colour of the carcass, but fortunately this prejudice does not yet exist in South Africa.

Some people maintain that the R.I.R. is the best farm breed. The bird is fairly active and a good forager in spite of its relatively high weight. Since it is fairly tame, control is comparatively easy. Unlike birds of other breeds, it does not readily become a nuisance in a garden.

The bird has many economic features but unfortunately certain difficult requirements as regards breed characters must be observed and this has exercised a retarding influence on the evolution of the breed. In South Africa we have laid down a standard for external appearance which cannot be easily maintained. In addition to this we make other demands in respect of characters such as egg-laying ability, hatchability, etc. In these circumstances, the task of the breeder is much more difficult with this breed than with any other. Consequently progress is slower. The Americans, however, adopted a different course. They used the R.I.R. as a foundation, disregarded breed characters and selected for stamina, egg production, hatchability, etc. In course of time they automatically adopted the colour which occurred most regularly and which could be most easily obtained, and named the new breed the New Hampshire Red.

Breed Characters.

Poultry-farmers endeavouring to build up this breed will find a short description of this bird most valuable.

In the Rhode Island Red two types of comb are to be found, namely, the single comb and rose comb. It is, however, doubtful whether the latter type occurs in South Africa. As stated above, the Rhode Island Red is a double-purpose breed, and as a rule it is difficult to retain both characters, viz., egg production and meat

production. It has already been noticed that good producers are inclined to be on the small side when compared with the average bird.

(*a*) *Conformation.*—The breed has a deep brick-shaped body, the average bird being heavy boned. The chest is deep, broad and long. The shoulders are broad, the back flat and straight. The body is borne horizontally. The head is moderately large and the beak strong, slightly curved, and yellow or horn-coloured. The comb of the cock is large and erect; that of the hen is much smaller but

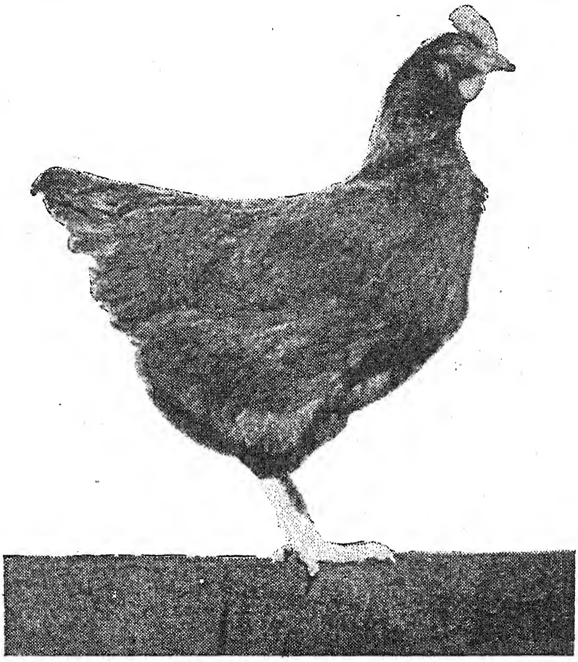


FIG. 2.—A hen with typical R.I.R. conformation.

should also be erect. The eyes are large, oval, orange-coloured and prominent. The face, earlobes, comb and wattles are red. The wattles should not be folded or wrinkled. The neck is of moderate length and the neck feathers of the cock should be well-developed and cover the shoulder. The wings are large, well-formed and borne high. The tail is of medium length and usually forms an angle of 40 degrees, giving the body a very elongated appearance. The cock has long sickle-feathers which are somewhat longer than the main tail feathers. The tail is well covered with soft feathers. The body feathers lie close against the body. Fluff appears fairly abundantly. The legs are moderately long, sturdy and wide apart with four toes to each foot.

The standard weights are as follows:—

Cock, $8\frac{1}{2}$ lb; cockerel, $7\frac{1}{2}$ lb.
Hen, $6\frac{1}{2}$ lb; pullet, $5\frac{1}{2}$ lb.

(*b*) *Colour of Feathers.*—The basic colour is brilliant red and the colour of the neck feathers deep red. When the wing is opened, both primary and secondary pin feathers should show black. In the case of the primary feathers the external part shows red, the lower part

black with a narrow red margin in such a way that the black does not show when the wing is held in its natural position. Of the secondary pin feathers only the lower part shows red, the remainder being black, so that only the red can be seen when the wing is folded. The more important tail feathers are black. The covering feathers are also black but reddish, close to the body. All over the body the colour should, as far as possible, be red in the same degree, except in the various parts of the wing and tail indicated above. The colour of the inner feathers should be red in all parts.

Disqualifications.

The following must be regarded as disqualifications:—

(1) An exceptionally weak appearance, lack of conformity with the most important breed requirements and a body-weight more than 2 lb. under the standard weight laid down for mature birds.

(2) Any bodily defects, such as a bent beak, back, etc.

(3) Wings which are not properly held up, or of which the secondary pin feathers do not fold in under the primary ones when the wing is folded, and twisted pin feathers.

(4) Absence of all the main tail feathers; twisted tail feathers or a skew or squirrel tail.

(5) Drooping combs or combs not quite erect and combs with sprigs. If the comb should, however, hang over slightly to one side, it is no disqualification.

(6) Any positive enamel white in the ear lobes (both sexes).

(7) Feathers, stubbs or fluff on legs, feet and toes or clear marks that such feathers have been removed from these parts.

(8) Duck feet and feet with more or fewer than four toes.

(9) Legs or feet which are not yellow or horn-coloured.

(10) White feathers visable from the outside.

If there is any doubt as to disqualification on account of certain characters, the bird should be given the benefit of the doubt.

Breeding.

In the case of the R.I.R., breeding is difficult, a factor which has a retarding influence on the development of the breed, since we have laid down external breed requirements and are at present using that as a foundation for the development of qualities like egg production, hatchability, etc. It is very difficult, however, to retain these outward characters and in the attempt to do so, we are limiting our selection to such an extent that characters such as constitution and type must be sacrificed. On the other hand, it must be clearly understood, that it is not the writer's intention to advocate that such characters as colour, etc., should be enitrely ignored, the idea being rather that breeding of the bird should be considered in all its aspects and that the attention should not be focussed only on characters which are of minor importance.

A further factor impeding progress in the development of this breed is ignorance in regard to breed characters. By way of illustration, the colour of the ear lobes may be mentioned—a point to which many breeders have never paid the least attention.

Type and Colour.

Progress in the development of this breed along the correct lines demands from the lover of this breed special attention to only few breed characters.

Type.—The R.I.R. is a type by itself, and this can be clearly seen in the accompanying photographs. The bird has a long straight

back and a well-developed chest. These characters give the bird that brick-shaped body which is typical of the R.I.R. We must select for this character, or else lose the meat-producing qualities of the breed. Perpetuation of type is undoubtedly the most important requirement, but sometimes it is regarded as of less importance than characters of economic value, such as high egg-production. For this reason, type is easily disregarded. The aim should be to breed birds

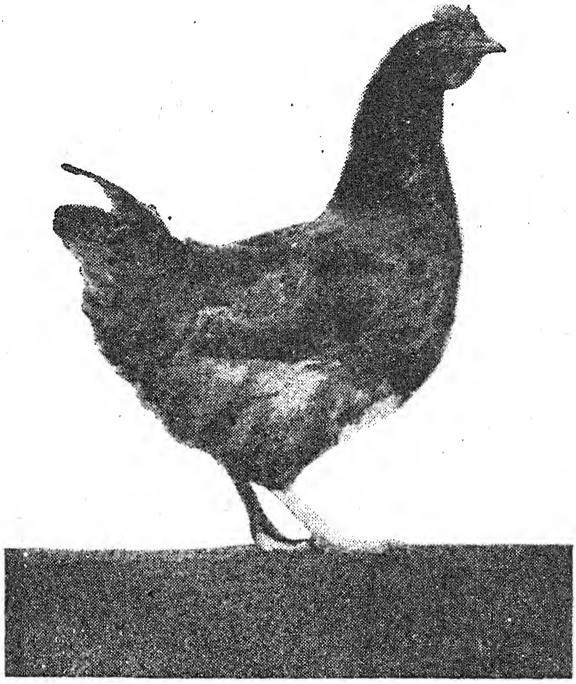


Fig. 3.—A remarkable feat! This hen was hatched on 23rd August, 1940, and laid her first egg on 6th April, 1941. Since that date until 3rd August, 1942, she has laid 390 eggs. She moulted without a break in egg-laying. Her production for the first year was 270 eggs of 2¼ oz. each.

with a good constitution combining the correct type with high productive qualities.

Colour.—Colour is the nightmare of every breeder. Obtaining a uniform colour in the flock by breeding is difficult, in fact, almost impossible. Although so much attention is paid to colour, it is invariably found that numerous deviations from the average colour of the flock annually occur. The breeder will be well advised to retain those birds which, as far as possible, satisfy standard requirements without sacrificing other characters such as type, stamina, hatchability, etc. Cocks with a dark ground colour should never be mated with hens of similar colour, since the ground colour of their offspring may be too dark, even black feathers may appear. The same principle applies to birds with a white ground colour. Hens with a dark ground colour should be mated to cocks with a light ground colour, and conversely. The ideal is a shiny brick red.

White ear lobes and light coloured eyes are other factors which present great difficulties and merit special attention. It is, of course, unnecessary to stress that birds with crooked keel bones, skew toes, etc., must not be included in the breeding pens.

Winter Crops in the Summer Rainfall Area:—

[Continued from page 248.

The rôle played by other winter crops in the summer-rainfall area should also be indicated here. From the point of view of pasture provision for as long a period as possible, wheat will produce the best results in the highveld areas of the Orange Free State and Transvaal. Where good and abundant early pasturage is required, e.g., for lambing ewes, oats give excellent results and will also provide good spring grazing again if moisture conditions are favourable. The Algerian types which are usually sown, make very little growth, however, during the cold dry mid-winter period and under extreme conditions will succumb much sooner than wheat. Although there is much to be said, therefore, in favour of oats as early grazing for sheep, farmers in these areas will do better by sowing wheat, but the price of the seed is also a factor to be taken into account.

Rye is also sown on a fairly extensive scale for grazing purposes, but in contrast with the view generally held, the water requirements of this crop are by no means lower than those of wheat, although it is certainly more resistant to cold and thrives better on poor and sour soils. Greater attention should, therefore, be given to rye in the eastern parts of the summer-rainfall area where soils are sour and cold, and where the rust-resistance of the crop will ensure better and more dependable spring pasturage.

Barley is less suited to dryland cultivation unless it is sown for green feed at the time of late winter rains or early in autumn. Under irrigation, however, the crop deserves much greater attention. As a rule, barley will produce a much heavier grain yield than wheat, and barley seed is well-known for its excellent qualities as a feed, especially for baconers. As a green feed, it produces larger yields and is capable of more frequent cutting than the other winter crops, but it is also the most sensitive to cold. One of the commonest mistakes made by irrigation farmers is that they irrigate their winter crops too often, especially during the earlier stages of development. Barley is particularly sensitive to over-irrigation and under such circumstances will produce poor results.

(F. X. Laubscher, Research Officer, College of Agriculture, Potchefstroom.)

Vegetable Fibre for Building Purposes.

OWING to the shortage of certain building materials, especially steel and timber, the Government has been investigating and testing substitute and alternative materials in order to alleviate the present position.

It is thought that vegetable fibres may play an important part as constituents for new materials.

The Building Controller intends to experiment with bamboo, reeds, grass, sugar-cane, sunn hemp and other fibres to be used as reinforcement in light-weight concrete; or as pulp for making ceiling boards, or as binder in gypsum boards, fibrous plaster, etc.

As there may still be other fibrous plants or other materials which could be put to some such use, and it is possible that the results obtained in actual practice by farmers and others have not been recorded, the Deputy Building Controller, Empire Buildings (P.O. Box 7795), Johannesburg, will welcome the co-operation and assistance of all farmers, who are hereby requested to furnish him with particulars of their personal experiences in the use of such fibres or materials in building construction.

The Potato-tuber Moth.

C. J. Joubert, Department of Entomology, Stellenbosch-Elsenburg College of Agriculture.

THE larva is the destructive stage of this small light-grey moth *Phthorimaea operculella* Zell. The full-grown larva measures about half an inch in length, and the colour may be dirty white or pale green. The head is black. The feeding period of the larva varies from about 20 to 40 days, after which it spins a silken cocoon on a potato, in the fabric of a bag, in a crack or corner of a box or among clods of earth on the soil surface. Inside the cocoon the insect changes to a pupa, and after about 2 weeks the moth emerges. Within a few days she lays her small eggs either on potato tubers or on host-plants on the lands. The eggs are barely visible to the naked eye and are pearly white. During summer the incubation period may be less than one week, while during winter it is about 2 weeks. When conditions are favourable six or more generations may develop during the course of one year.

Control in Stored Potatoes.

(1) One of the most suitable places in which to store potatoes is a room in which the temperature never rises unduly, and the doors and windows of which are screened, in order to prevent the small moths from entering the store-room. The surface of the floor and walls should be smooth and hard, so as to facilitate cleaning operations, when this should be necessary.

(2) Potatoes which might have been in contact with the pest, should be fumigated with carbon bisulphide (CS_2) before being placed in the store-room. Tubers are frequently infested before removal from the lands.

(3) Before bringing in a new crop, make sure that the store-room has been properly cleaned. Fumigate all infested material which may be found on the property. Infested tubers which are of no value may be cooked and fed to stock. On a farm one frequently finds some bags or boxes in rooms or buildings, containing tuber-moth material, which make it impossible to control the pest satisfactorily. Bags or boxes which had contained infested potatoes must be fumigated or dipped in boiling water.

(4) For *fumigation*, place the potatoes in a *gastight* room or tank; on top of the stack place one or more shallow pans or dishes to serve as containers for the liquid. For every 1,000 cu. ft. of space use 2 pounds (about 4 teacups full or 28 fluid ounces) of CS_2. Secure the doors and windows in such a manner that no gas will escape, and do not open the room until a period of 48 hours has elapsed. For successful fumigation the temperature should not be lower than 70° F. In practice a sufficiently high temperature can usually be obtained in the following way:—

When making use of a room, choose a warm day, and shortly after sunrise, open wide all doors and windows and leave them open. At the same time place the potatoes outside in the sun for a few hours. In this way both the room temperature and the temperature of the potatoes can be raised considerably. Now replace the potatoes in the room without delay, and securely close the windows, etc., leaving only one door open. Then place the CS_2 in the containers on top of the potatoes, using 2 pounds per 1,000 cu. ft. whether the quantity of potatoes is large or small. Immediately after placing the dosage in the room, close the door securely.

When a metal tank is to be used as a fumigation chamber, it should be placed in the sun, along with the potatoes. Then place the tank in such a position that it will be exposed to the sun for about 2 hours per day during the period of fumigation. Prolonged exposure to the sun may cause the temperature to rise too high and damage to the potatoes may result.

Carbon bisulphide (CS_2) is a colourless liquid which on evaporation will render a heavy malodorous gas. Both liquid and gas are highly inflammable, and labourers should be warned of the danger of fire in any form. Electric sparks may also ignite the gas, causing it to explode.

Unfortunately the eggs of the potato-tuber moth are not killed by the gas, and this necessitates a repetition of the treatment after a period of about a week, during summer, and after about two weeks in winter. The second fumigation will kill the larvae which hatch from eggs present at the time of the first treatment. Fumigated potatoes should be placed in a properly prepared store-room, so as to prevent reinfestation.

Control on the Lands.

(1) Do not plant infested tubers, because the moths which emerge from them will lay their eggs on the tops of the potato plants. The larvae which hatch from these eggs, enter the stems of the plants or feed in the tissue of leaves. The pest will thus carry on until the new tubers are ready to be attacked, particularly when the soil begins to crack, and when ridging is not practised.

(2) By ridging the soil along the rows of potato plants, the new tubers can be protected by a layer of soil of such depth that it will be almost impossible for the pest to reach them. If this work is done too early, tubers which develop in the ridge will cause cracks through which the pest could enter. Wait until the plants are well up, and then begin to work up a ridge gradually, building it a little higher with each cultivation, especially when the plants begin to bloom. Just before the tops of the plants begin to brown and dry, the ridges should be complete.

(3) Deep planting can also be recommended as a means of protecting the crop against the pest. Where a suitable soil and other conditions obtain, the tubers may be planted at a depth of 4 or 5 inches.

(4) Other host-plants of the potato-tuber moth are the gooseberry, tomato, tobacco and Datura (stinkblaar). Volunteers of these plants as well as volunteer potato plants, must be rigorously suppressed on lands which are to receive the new potato crop.

(5) A system of crop rotation is strongly recommended. Under such a system none of the above-mentioned crops will follow any of the others on the same land, nor may any kind of crop be grown twice running on the same land.

(6) Potatoes should not be left overnight on the lands at the time of harvesting, nor should the discarded potato tops be used to cover them. The crop should be moved directly to the market or to a suitable storeroom.

(7) Small potatoes and other culls which are usually discarded on the lands, should be gathered, and fed to pigs or buried under at least two feet of soil.

(8) A measure which may, under certain conditions, be valuable, is the removal, at harvest time, of infested tops, and the cultivation of the soil immediately after the crop has been removed. The infested tops may be packed inside a compost heap.

Mangels.

Dr. P. D. Henning, Senior Lecturer in Agronomy, Stellenbosch-Elsenburg College of Agriculture.

MANGELS (*Mangold*, *mangelwurzels*) are closely related to the common garden beetroot, but are hardier and more resistant to unfavourable conditions. Although they can be cultivated on a variety of soils, the heaviest yields are obtained on deep, fertile loamy soils. On the other hand, they also grow well on soils which are too alkaline (brak) for most other cultivated crops. Once the crop has been established, it is highly resistant to drought. It is not

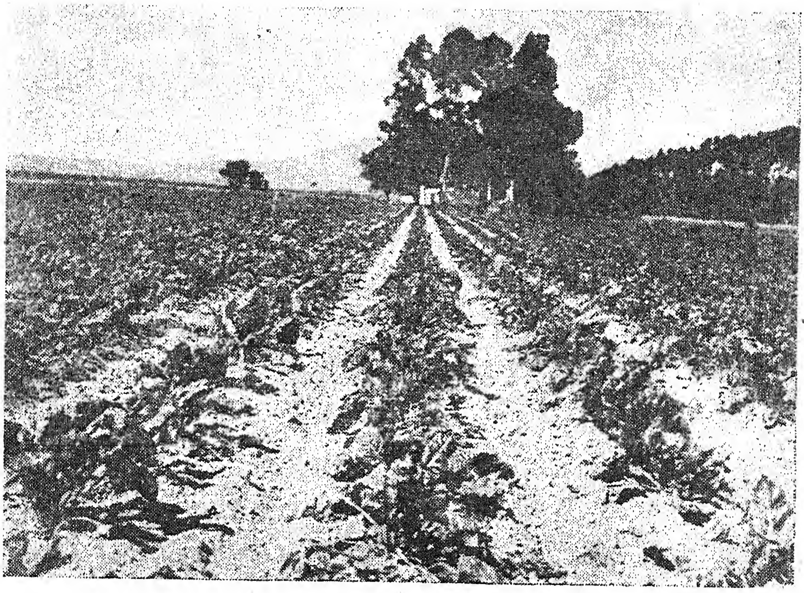


FIG. 1.—A good stand of Mangels.

resistant to severe frost, but in the greater part of the winter-rainfall area, it may be planted in winter without danger of frost damage. In the drier areas, mangels must be grown on the deeper, low-lying soils. In areas with a comparatively high rainfall, as in the Stellenbosch district, or in parts where the summers are not too dry and hot, such as the Rûens area (Caledon-Bredasdorp) this crop can be very successfully cultivated on hillside soils.

Mangels are rich in sugar and starch, but poor in proteins, and for this reason its nutritive value for milk-producing animals is not as high as that of kale. Nevertheless it is a very valuable succulent fodder plant for this area owing to the succulence which it provides at a time of the year when green feed is very scarce and frequently unobtainable, viz., from January to May.

Seed-beds.

As in the case of kale, the best results are obtained by first sowing the seed in beds and subsequently transplanting the seedlings. The preparation of the seed-beds is the same as for kale,* but owing

* (See article elsewhere in this issue.)

to the higher rate of seeding in the case of mangels, and the smaller number of seeds per lb., 8 ounces of seed will furnish sufficient seedlings for a quarter of a morgen only.

Sometimes mangel seed is sown directly on the lands. Apart from the fact that this practice necessitates the use of a much larger quantity of seed, it frequently results in crop failures, particularly if the soil is inclined to crust over. In such cases, germination is extremely poor and the resulting stand unsatisfactory. Furthermore, weeds are very troublesome at this time of the year, with the result that the germinating seedlings are easily choked. Consequently, direct sowing cannot be recommended as a general practice in this area.

When the seedlings have reached a height of 6 inches they are transplanted, in rows 3 ft. apart with a distance of 18 in. between the plants in the rows; in dry parts the latter spacing may be as wide as 24 inches. In dryland areas, the best results are obtained if transplanting is carried out from May to June, since if this is done, the plants are already strong and well-established by the time the hot weather sets in, and are, therefore, better able to stand up to the unfavourable summer conditions. Under irrigation or on soils with a high moisture-retaining capacity, mangels may be successfully planted as late as October. After transplanting, the crop must be cultivated between the rows at regular intervals for weed control.

Mangels treated as described above, will be ready for use from December to May. All the plants are not harvested together, but are left in the soil and removed as required.

Varieties.

At present, the seed of only a few varieties is obtainable. Most important of these are "Long Red" and "Yellow Globe". A variety-test carried out over a number of years revealed that Long Red has a higher dry-material content and also gives a higher yield of dry material per morgen than Yellow Globe. As its name indicates Long Red is a long, red mangel which penetrates comparatively deeply into the soil, so that it is frequently very difficult to remove when the soil is hard and dry. Yellow Globe, on the other hand, is a round, light yellow mangel and in contrast with the former variety, almost the whole of the thickened root portion develops above the soil surface; it can therefore be removed very much more easily and at lower cost when the soil is dry and hard. Thus, in spite of the fact that Yellow Globe gives a lower yield, it is frequently given preference to Long Red, when planted in comparatively heavy soils.

The Value of Good Seed:—

[*Continued from page 254.*

The methods employed for disinfecting seed are often antiquated and ineffective, and in this matter, too, farmers are advised to consult their colleges of agriculture.

Diseases can be spread in numerous ways, as for instance by direct contact with contaminated seeds, by wind, by the use of old contaminated bags, by threshing machines, etc. Farmers cannot be too careful.

If farmers remember that the cost of seed generally constitutes a small percentage of the total cost of producing a crop, they will not be unwilling to pay a few shillings extra per bag for good seed or to take a little more trouble and precaution to produce good seed. The increased profit which they can confidently expect when adopting such a course, will more than justify the extra expenditure.

Crop Production and Soil Fertility.

F. M. du Toit, Professional Officer (Field Husbandry),
George, C.P.

AS in other parts of South Africa, the farmers in the George and Knysna districts and in the Little Karroo area of the Cape Province have responded in a striking manner to the urgent need for increased food production. The greatest increase has taken place in the following lines of production.

Potatoes.

Soil and climatic conditions in the coastal belt are particularly suited to the growing of tuber and root crops, and the production of Irish and sweet potatoes has steadily increased in this area since the 1939-40 season. The most valuable contribution has been in connection with seed-potato production. In 1941 three Seed-Potato Growers' Associations were established and, together with many private growers, they have done much to maintain the supply of healthy vigorous seed. In the case of sweet potatoes, also, it is of interest to note that a great proportion of this crop, grown at inland centres, owes its origin to runners produced in the coastal areas of the George and Mossel Bay districts. In the Oudtshoorn, Uniondale and Langekloof areas potato production has also greatly increased. Estimated conservatively, the potato crop in the Oudtshoorn district in 1941-42 was more than four times that produced before the war. In both the coastal area and in the Little Karroo two crops are grown per season. In the coastal area the summer crop is generally more successful, whereas in the Little Karroo better results are usually obtained from the early winter crop (i.e. from potatoes planted in February).

Vegetables.

These districts are situated at a convenient distance from both Cape Town and Port Elizabeth, and the stimulus given by the improved markets at these centres has resulted in a big increase in the vegetable production, particularly in the coastal area. The main contribution from the Little Karroo has been in respect of vegetable seeds. Portions of Oudtshoorn, Uniondale and Willowmore are particularly well-suited for this purposes. A recent survey carried out by the Division of Horticulture in these districts, showed that in the case of onions alone, the following increases in production has taken place: In the 1941-42 season 250 bags were planted for seed, compared with 2,000 bags in the 1942-43 season. There appears to be a good future in this area for the production of beet and carrot seeds.

Hops.

During recent years the acreage under this crop in the George district has shown a steady increase, and further areas are being developed at present. The crop is a particular intensive one, requiring a considerable capital outlay, as well as fertile soil and a high rainfall. At present the area under this crop is between 80 and 100 morgen, and it seems as if this district will, in the near future, be able to supply the country's main needs.

Tobacco.

The shortage of labour during the past few years has limited tobacco production in the Oudtshoorn area to some extent, but the farmers are gradually becoming better equipped with sheds, cellars

and grading-rooms. Each season has brought about a gradual increase in the percentage of the lighter grades of air-cured tobacco which are to-day so urgently needed by the manufacturer. The demand for good quality dark types for twisting, is at present larger than the supply, but with the return to normal conditions this type of tobacco may suffer a setback owing to overproduction. Some idea of the rapid dévelopment in the production of flue-cured tobacco in the neighbouring area of the Gamtoos Valley can be formed from the fact that over 80 barns are at present in operation, whereas in 1937 there were only 10. Here the soils are more suitable for flue-cured tobacco, than those of Oudtshoorn, and since White-Stem Orinoco is mainly grown, the quality of the crop is a very valuable asset of the tobacco-growing industry of the Union.

Maize and Wheat.

It is very desirable, from the soil-fertility point of view, particularly in the coastal area, that more live-stock be kept, and since the natural grazing of the area is poor, the most advisable policy is to plant more maize to be fed on the farm. This applies particularly to the western part of the coastal belt, west of the town of George, where weather conditions are more favourable for maize production than further east. For satisfactory yields in this area, liberal applications of kraal-manure and compost are required, as well as applications of phosphatic fertilizers.

Both in quality and in yield of wheat, the Little Karroo gives more satisfactory results than can be obtained with this crop in the coastal area, but the production of winter cereals, as well as maize, should be considered with the object of providing home-grown grazing and forage crops rather than cash grain crops. If this were done, the fertility problem of the coastal area would gradually solve itself.

Other Crops.

Under present-day conditions and overseas supplies of food materials no longer being available, the following crops, produced in the areas indicated, have done much to augment our diet. Dried fruit, raisins, currants, from the Prince Albert and Calitzdorp areas; apples and other deciduous fruit from the Langkloof; berry fruits from George-Knysna; dry peas and dry beans as well as wheat, barley, oats, rye and a great variety of viticultural and dairy products from the area as a whole. Licorice root is an example of the war influence upon local conditions. Not only did the price rise to nearly four times its normal level, but great quantities of this root have been cultivated by farmers in the Oudtshoorn district.

Soil Fertility.

If production is to be maintained at its present high level, farmers cannot afford to neglect the all important question of soil and soil fertility, for on the maintenance of soil fertility depends not only their own future, but that of the country as well. The area under discussion falls into two distinct parts, each having its own set of problems, viz., the coastal area, and the Little Karroo.

Soil Fertility of the Coastal Area.—Whereas water is the limiting factor in the Karoo, in the coastal area it is definitely soil fertility. Under such conditions it is essential, to-day, that farmers must cultivate more fodder crops so that the plant material can find its way back to the soil in the form of farm manure, which must be conserved and increased by the manufacture of as much compost

as possible. The area is well covered with masses of scrub bush and other growth, which can profitably be converted into compost. In this respect it is encouraging to note that the George municipality is one of the first in this area to undertake the Municipal Compost Scheme, sponsored by the Department. The compost should find a ready market among local farmers. The introduction of vetches and dryland-lucerne as crops for the improvement of the soil is essential.

Soil Fertility of the Little Karoo.—Farmers in this area fall into two distinct groups, viz., those situated on the flats, away from the mountain ranges, where the average size of the farm is large, and a fair number of livestock is kept. Often as much as 75 per cent. of the irrigable land is under lucerne. From the soil fertility point of view the farms in this area do not present many serious problems. From the Olifants River Valley, for instance (between the town of Oudtshoorn and Calitzdorp), many hundreds of tons of kraal-manure are annually railed to other parts of the Union. The second group of farmers constitute the small irrigation holdings, situated along the valleys of the mountain streams. Here the limitations of soil and climate have resulted in the evolution of an extremely intensive type of farming. It is particularly on these small farms that a serious fertility problem is developing to-day. Here the rainfall is usually higher than on the farms on the flats. The water of the rivers is fresh and there is no brak problem, but in order to maintain production, farmers find it necessary to purchase kraal-manure for tobacco and potatoes. The main crops grown on the small farms are tobacco, potatoes, wheat, barley, peas, beans, etc. In most cases 1½ to 2 morgen of the irrigable land is under vineyard and fruit. Because these holdings are dependent on the sale of cash crops, an insufficient number of live stock is kept. Consequently the proportion of the farm under lucerne is usually too small, and an insufficient quantity of kraal-manure and compost is produced. It will be realized that over a period of years the intensive cultivation of these small holdings (many as small as 4 to 6 morgen), under such conditions, will seriously deplete the soil. It is under these conditions of irrigation farming in warm climates that the farmer must guard against the dangers of soil depletion, erosion and the accummulation of diseases and pests in his soil.

Methods for Soil Improvement.

The best methods of maintaining the productivity and fertility of these farms are the following:—

(1) Terrace and level all irrigation lands. Failure to do this has been responsible for more loss of fertility than any other single factor. Farmers in this area are alive to the danger of their surface soils being washed away. When most of the lands of the Little Karroo were still under lucerne very little loss of this nature was sustained, but in recent years more and more lands are being planted to potatoes and tobacco and other intertilled crops. Many startling examples of scouring of lands under these crops are in evidence throughout the area.

(2) Make more use of lucerne as a short-term rotation crop. From the point of view of soil fertility, the years of profitable ostrich-farming were probably the most favourable the Little Karroo has ever seen, for during that time more than 75 per cent. of the irrigable lands was under lucerne. The most hopeful aspect in connection with the problem of soil fertility on the Little Karroo is that lucerne

is so well adapted to its soil and climatic conditions. The crop nodulates freely throughout the area and artificial inoculation is not necessary. The deep rooting system of lucerne opens up the sub-soil, improves drainage and does not overtax the already exhausted surface soil in which most commercial crops have their feeding roots. When lucerne lands are ploughed up after 4 or 5 years the physical condition of the soil is always improved. The nitrogen and organic-matter content of the soil are higher, and if proper levelling is applied the soil will be in a suitable state for the cultivation of intertilled crops under irrigation.

(3) With a view to introducing more lucerne into a proper system of crop rotation, the following system is suggested: sow wheat with lucerne in about May. After the wheat has been harvested, leave the land under lucerne for about 4 years. Then follow up with potatoes in August, and tobacco in December. A winter cereal, such as oats or barley, may then be sown; followed by tobacco the following summer, and then a crop such as peas or vetches. Potatoes may then be planted as a summer crop, and in May the land may again be put under wheat and lucerne. In this way roughly half the irrigable area of the farm can be kept under lucerne. In cases where nematode is a serious problem, sunn hemp will have to be introduced as a summer crop.

(4) Make adequate supplies of compost. As wheat and other winter cereals are grown on all these farms, a great contribution to the fertility of these soils will be affected if all straw and other waste-material is converted into compost.

Inspection of Meat on the Farm:—

[*Continued from page* 252.

which can be hung at the place where animals are slaughtered, is supplied to serve as a guide:—

Free Services by Veterinary Division.

In cases of doubt as to the edibility of meat or the possible harmful effects of any lesion or condition, a Government Veterinary Officer should immediately be consulted; in areas falling under a local authority, the health inspector should be called in to investigate.

It is convenient to have an isolated cool storeroom on the farm where meat with doubtful lesions can be hung until a veterinarian's advice has been obtained. Lack of such accommodation may lead to the loss of meat which may otherwise have been passed as fit for consumption.

The production of meat by-products is not an undertaking which is adapted to present farm conditions, but certain types of rejected meat can be used for making soap or meat meal. This practice is, however, not generally recommended.

Finally, the writer would like to repeat here a line of wisdom from an earlier civilization.

"Feed your slaves as you would yourself". This maxim is as old as historical man himself and we must remember that meat which has been rejected for reasons of health must be destroyed or buried and not left where natives or dogs can get at it. Neglect of this precaution will lead to the further spread of disease with harmful results, not only to the owner, but also to the workers and the livestock on the farm.

The Biology of the Citrus Thrips.

E. C. G. Bedford, Entomologist, Division of Entomology, Pretoria.

EVERY citrus exporter nows only too well that large quantities of oranges are annually rendered unexportable by the unsightly blemishes produced on the fruits by the citrus thrips, which is one of our major citrus pests.

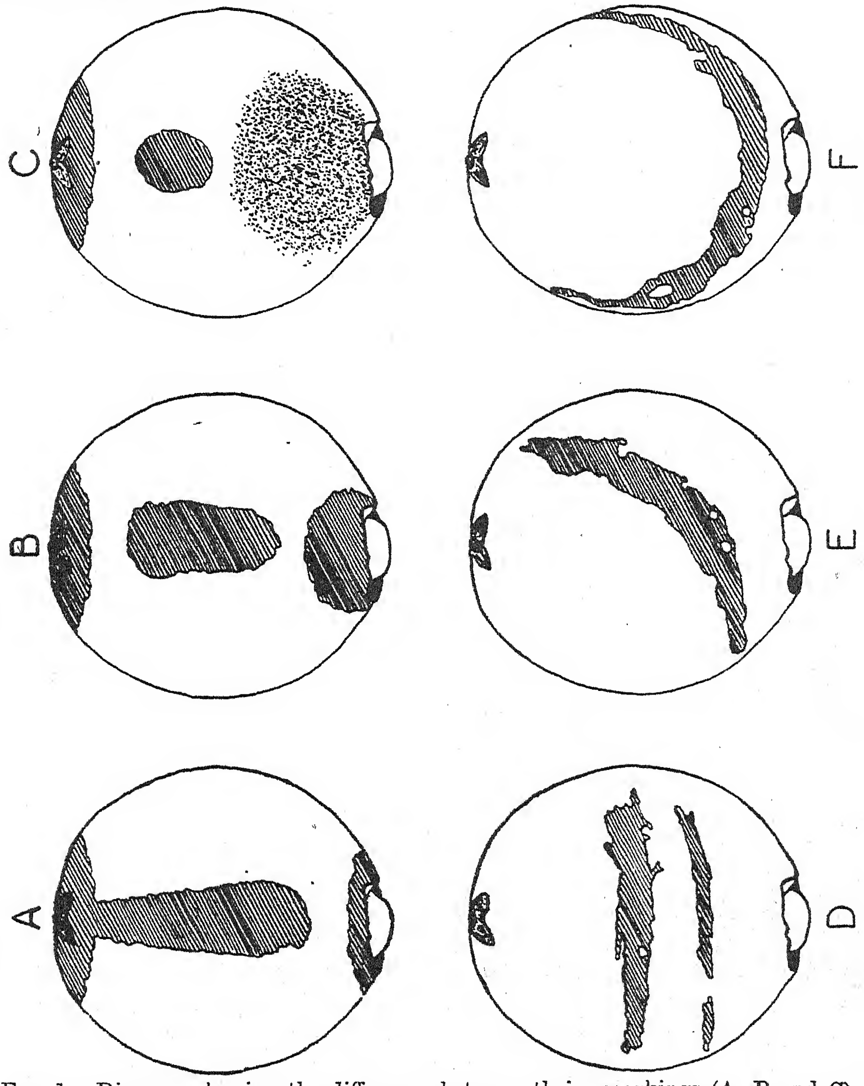


FIG. 1.—Diagram showing the difference between thrips markings (A, B and C) and wind markings (D, E and F). Early thrips feeding has produced navel end markings in figures A and B. Late thrips feeding has produced browning at the navel end in figure C.

Life Cycle.

The adult citrus thrips is a minute orange-yellow insect, a little les than $^1/_{25}$ inch in length. It has four fragile wings, but is quite a strong flier. The adults and larvae of the citrus thrips feed by piercing the plant tissues with their needle-like mouth-parts and

sucking out the juices through the microscopic punctures, thus blemishing the fruit or foliage. The female possesses an egg-laying apparatus by means of which she lays her eggs inside the young foliage and the green fruit. During the summer in the Rustenburg district of the Transvaal, one or two eggs are laid every day, and the insect lives for about three or four weeks. The eggs hatch in 6 or 7 days, and the larvae, which are responsible for most of the damage, feed on the foliage and fruit for a further 6 or 7 days. They then drop off the tree after sunset and crawl into the ground to pupate. Here they remain quiescent for 5 days, during which they transform into prepupae and then into pupae, finally emerging as adults which begin laying eggs two or three days later.

There is no resting stage in the life cycle of the citrus thrips, and all stages of the insect occur throughout the winter, although the pest is usually very scarce during July and August. The duration of the life cycle from egg to adult varies from 18·4 days in summer to 44 days in winter. There are about 10 generations of the citrus thrips per year.

Several kinds of natural enemies were found which fed on the larvae and adults of the citrus thrips, but none of these seems to be of any importance in reducing the numbers of the pest while the fruit is susceptible to thrips injury.

Fluctuations of the Citrus Thrips Population.

The abundance of the citrus thrips and hence the amount of thrips damage, is determined by weather conditions, chiefly temperature and rainfall, from mid-winter to mid-summer. For instance, during the 1938-39 season, when the weather from July to November inclusive was very hot and dry, severe thrips marking and severe browning were produced, while the weather during the same period of the following season was much cooler and wetter, and only slight thrips damage resulted.

A census of citrus thrips larvae and adults was taken every fortnight during the 1939-40 season in a Washington Navel orchard and in a Valencia orchard near Rustenburg. The pest was found to be present and breeding in the orchards throughout the year, although it became extremely scarce during mid-winter. The fluctuations of the citrus thrips population in the Washington Navel orchard during the 1939-40 season were as follows:—

April to September: The citrus thrips population decreased from the end of April until the beginning of August, when the population was at a minimum. There was a simultaneous decrease in the temperature and in the amount of young out-of-season foliage and fruit, these being the two main factors which limit the winter population of this insect. From the beginning of August, the thrips population increased as the temperature rose.

October: Two applications of sulphur dust were effective in reducing and checking the initial infestation during this month. By the middle of October no thrips had yet appeared on the new fruit, which was about the size of a small pea, and the insect was still scarce on the young foliage. A few adult citrus thrips began to move from the young foliage to the young fruit and to lay eggs in it during the third week of October.

November: The total population of the second or late infestation of citrus thrips increased steadily from the beginning of November until its peak was reached in the middle of January. As in most orchards in the Rustenburg district, it was unnecessary to control

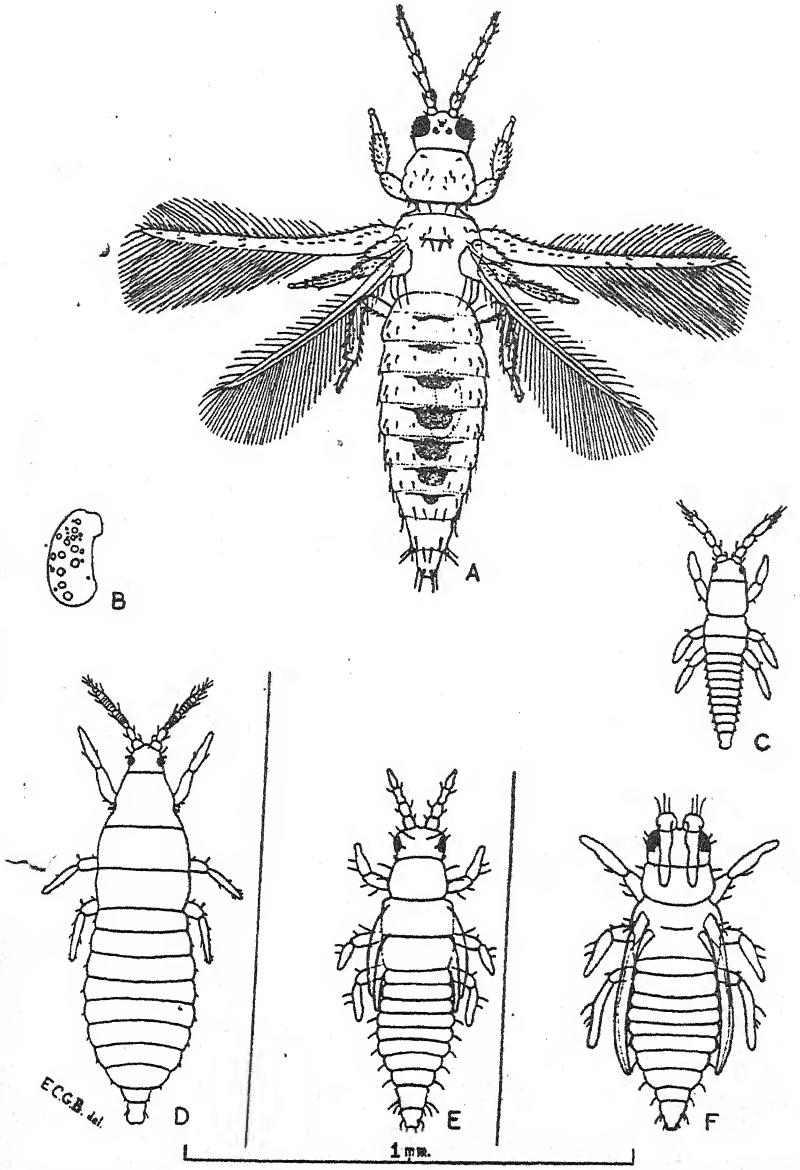


Fig. 2.—The Adult Citrus Thrips with its egg and the various larval stages of development.

this second infestation during the 1939-40 season; only 0·7 per cent. of the fruit on the trees inside the orchard was culled.

On the four corner trees of the orchard, however, the second infestation of adults increased very rapidly from the beginning of November; this increase may have been due to a migration of citrus thrips from the surrounding veld. Larvae became abundant on the fruit on these outside trees, and they scarred the fruit extensively during the second and third weeks of November, while the fruit grew from 21 to 29 mm. in diameter. Observations indicate that these two weeks constituted the critical period during which most of the thrips

damage was done. Fourteen per cent. of the fruit on the four corner trees was graded as culls. One or two late dustings after the beginning of November were obiously necessary in this case to keep the fruit commercially clean.

December: No thrips damage of any importance was produced after the beginning of December. Although the thrips population on the fruit was highest towards the end of December, and it was still fairly high in the middle of February, the insects were scattered over the larger surface-area of the fruit, and did not seem to do any damage.

January-July: After the middle of January the total thrips population continued to decrease until July 1940, when the thrips were again rather scarce in the orchard.

The citrus thrips has been found on a remarkably large variety of different plants; these number 71 species and belong to 31 different families.

Discarded citrus orchards, and host-plants of the citrus thrips which are found growing in the veld adjacent to citrus orchards, serve as breeding grounds for the pest, and an infestation of the orchard from these sources may be of considerable importance. Certain native Acacias seem to be the favourite food-plants, the pest being most abundant on these trees, which are often common in the veld around citrus orchards.

It is possible that the spring infestation of citrus thrips in the orchard is produced largely by adults, which have migrated by chance from weeds and veld plants to the orange trees during August and September. If this is so, the removal of all the important host-plants of this pest in and around the orchard should reduce the spring infestation considerably.

Thrips Blemishes and Wind Blemishes on Oranges.

The writer has confirmed the fact that the well-known stem-end-ring marking is only produced by thrips. But both thrips and wind produce markings on the sides of citrus fruits, the difference between the two types of blemishes being at first confusing. The surfaces of both thrips blemishes and wind blemishes are remarkably similar in appearance, and the one can merge imperceptibly into the other. However, each of these two types of blemishes can be readily recognised by its shape, depth, and position on the orange.

Some citrus growers incorrectly blame the citrus thrips for most side-markings, even in cases where they are caused chiefly by wind. The following descriptions and the accompanying figure will probably enable the citrus grower to distinguish between thrips markings and wind markings on the sides of his oranges:—

(*a*) *Wind markings*.—These are transverse scars (Fig. 1-D) or diagonal scars (Fig. 1-E and F) across the face or the blossom (navel- -end of oranges. They are elongate and often arc-shaped, and are usually more or less sunken, with irregular edges.

(*b*) *Thrips side-markings* (*tear stains*) *and navel-end markings*.—Thrips side-markings or tear stains (so-called because they run down the face of the fruit like a tear) lie with their long axis more or less parallel to the longitudinal axis of the fruit; they are broad or elongate extensions of the thrips stem-end ring over the shoulder and face of the orange (Fig. 1-A), or, if separate from the thrips ring, they are usually elongate or oval blemishes (Fig. 1-B and C), but sometimes they are circular in shape. Thrips navel-end markings (Fig. 1-A and B) are more or less circular blemishes at the edge of or around the navel-end of the fruit. Thrips markings are typically

level with the surrounding healthy tissue, and their edges are more or less regular in outline.

Thrips tear stains are common wherever the insect has been numerous on the young fruits, especially while it is from the size of a pea to that of a walnut. They are usually formed by thrips feeding under twigs and leaves, or between touching or approximating fruits. Bad tear stains seem to be produced chiefly during the second and third weeks of November.

Browning or Late Thrips Marking.

When the citrus thrips are abundant on young fruit, they often concentrate to feed on the exposed blosson-end of the orange, especially during early morning and late afternoon, when they enjoy the direct sunlight. In this way, more or less circular blemishes are produced around or at the edge of the navel (Fig. 1-A and B) or, in varieties without a navel, the base of the dehisced style. But when the fruit is about the size of a golfball and larger, thrips feeding in a similar position near the navel-end produce a different type of blemish known as browning, late thrips marking or russet marking (Fig. 1-C). When the fruit is half grown or larger, the thrips are more scattered over the increased surface area of the rind. The epidermis of the fruit does not grow so rapidly then, and is tougher, so that the insects cannot injure it to the same extent as in the tender young fruit. The result is that late thrips-marking differs in appearance from the common thrips-marking, although both are produced directly by thrips.

Browning is probably produced from about the beginning of December to the end of February. It shows on the green fruit in March as a reddish-brown blotch which darkens as the orange matures. The final browning is a smooth, mottled, brown or dark-brown blemish. It is typically a more or less circular or oval blotch on the exposed lower half of the orange, above the navel-end. Browning was produced experimentally in the orchard from December to March by confining citrus thrips in celluloid cages enclosing large oranges. Typical browning developed on the exposed sides of the oranges where the insects had fed.

Direct sunlight seems necessary for the development of browning for this blemish only occurs on the exposed sides of oranges and is not found on fruit inside the tree. Thrips feeding on the shady sides of late oranges in cages in the writer's experiments produced no blemish whatsoever.

Wind Marking.

Blemishes produced on oranges by wind may cause even greater losses than such insect pests of citrus as the citrus thrips. Allwright (1939), referring to orange orchards in South Africa, which are subject to wind damage, states: "If all the orchards had been protected effectively against wind . . . the windbreaks would have increased the total returns for this season's (1938-39) crop, valued at £750,000 on the tree, by about £80,000 . . . entirely as a result of having cleaner fruit".

It is, therefore, important that the citrus grower should be able to distinguish clearly between thrips and wind marking.

A single very strong wind blowing for a few hours is sufficient to cause severe wind marking on oranges on the exposed sides of the trees. The fruit is most susceptible to wind marking when it is the size of a pea. The majority of wind markings are caused by the older leaves being blown to and fro during a strong wind so that their hard

edges, or the mid-ribs of their lower surfaces, continually scrape against the small tender fruits. On account of the relative positions of the leaves and the fruit, to-and-fro movement of the leaves against the fruit produces the typical transverse or diagonal wind blemish, which is often arc-shaped.

Citrus Nematode Investigations:—

[Continued from page 260.

keeps infested trees in a good state of productivity, even though high infestations of nematodes must cause some injury to trees, in that they undoubtedly drain the roots of a considerable amount of nutritional juice.

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NOTICE.

For general information it is notified that the Home Economics Bulletin *Foods and Cookery* is out of stock.

New Bulletins.

Reinforced Circular Reservoirs. Bulletin No. 234 3d.
Eggs and Poultry in Cookery. Bulletin No. 237. 6d.
Bush Tea. Reprint No. 8.
Linseed and its Cultivation. Reprint No. 16.
Pyrethrums. Reprint No. 41/1940.
The Planting of Potatoes. Reprint No. 14.
Crop-production Policy in the Present Emergency. Reprint No. 37.
Nicotine for Aphids. Reprint No. 30.
Legumes in Crop Rotation. Reprint No. 38.
Specifications for the Construction of Circular Dams.
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Poisonous Plants. Reprint No. 70/1941.
Poisonous Stock Feeds. Reprint No. 51/1941.
Artificial Incubation of Eggs. Reprint No. 32.
Rearing and Feeding of Chicks. Reprint No. 18.
Compost. Reprint No. 34.

Labour.

P. E. de Waal, Department of Agricultural Economy, Stellenbosch-Elsenburg College of Agriculture.

THE type of farming system and practice suited to any particular area is determined by a great variety of factors. Success in farming is also conditioned by numerous factors which make the problems with which the farmer has to cope more intricate. The fact that few farmers correctly understand the working of these factors explains the lack of purpose and system in the methods adopted on so many farms.

One of the farmer's main problems is labour. In almost every type of farming, labour constitutes the most important item of costs.

The best results can be obtained only if the necessary attention is given to *all* cost factors, since the farmer's profit is determined not only by the price which he obtains for his product but also by the production costs. If, however, one single factor merits particular attention, that factor is labour, and it is for this reason that effective utilization of labour and a relatively high production figure per labour unit are pre-requisites for successful farming.

The important consideration is not the amount spent on labour, but the production per £ spent on labour. The question of labour cannot be solved merely by employing additional labour or cheaper labour, but rather by utilizing labour more effectively than the average farmer is doing at present. Those farmers who are able to increase their income per labourer most rapidly over a number of years stand the best chance to succeed. Those who are unable to do so, will in course of time find it increasingly difficult to succeed, since they will be compelled to pay wages based on the increased efficiency of the operations of their neighbours.

An increased production per £ spent on wages can be obtained either by increasing the production of the farm without raising costs of labour or by reducing the labour costs item without a corresponding decrease in the total farm income. As a rule the first alternative is the better, since such costs as interest or rent, depreciation, repairs, taxes, etc., remain fairly steady, and an increase in the total production of a farm therefore reduces per-unit figure of these steady items of expenditure.

With a view to increasing their production farmers should not only grow more crops and keep more animals, but should also pay more attention to the soil and the feeding and management of stock.

As compared with unprofitable farms profitable undertakings on the one hand spend more on feeds, fertilizers and labour, but on the other produce more per £ of costs. In the latter case the number of eggs per hen, the quantity of milk and meat per 100 lb. of feed and the yield per morgen, etc. are generally higher.

Poorly balanced stock feed entails waste of labour as well as feed, since animals have to be cared for irrespective of whether they make rapid growth or not or produce much or little.

Although it can be assumed that the productivity of labour has been considerably increased during recent years, there still remains much scope for improvement on most farms. Labour can be made more productive by introducing some technical improvements or other in the method of production, such as the use of labour-saving equipment, better balanced fertilizers, etc.

Increased productivity of labour may also be obtained by effecting a change in the existing relationship between stock and crops on

 [Continued on page 289.

Sheep-Farming in Time of War.

P. J. J. van Rensburg, Department of Animal Husbandry, Stellenbosch-Elsenburg College of Agriculture.

SHEEP-FARMING is influenced directly and indirectly by the war. In belligerent countries the sheep population generally shows a sharp decline.

To-day there is a very heavy demand in South Africa for wool and meat, especially meat.

During the recent war years, artificial and other fibres have been mixed in ever increasing quantities with wool in the manufacture of textiles, and the use of artificial fibres without wool has increased to a still greater extent. There has, however, also developed an unusually heavy demand for woollen goods for the fighting forces and this has proved once again that wool is still indispensable as a textile fibre. Like many other farmers, the wool-farmer must, however, reckon with a possible decrease in the purchasing equivalent of his product, with the result that the future of the wool-farmer remains uncertain.

The sheep-farmer must, therefore, make the best use of prevailing conditions. He must do everything in his power to keep his sheep-farming on the most profitable basis and, wherever possible, to allow it to take its rightful place in a system of mixed farming.

There are experts who hold that South Africa has too many sheep. Many farms are overgrazed already. It is not only uneconomic to allow overgrazing, but the results of such a policy may be disastrous to the future of the sheep-farmer.

Now, more than ever before, there is need for the farmer to stabilize the number of his sheep on the basis of average conditions so that that side of his enterprise can be made to fit in with his general farming system. He must make sure that he is applying the correct system. Wherever possible, the carrying capacity of the soil should be increased by providing the necessary fodder crops and pasture.

Hints.

Breeding and Selection.—There is a good market at present for the less profitable type of sheep and the farmer should, therefore, make use of this opportunity to get rid of his culls. Only the best breeding animals should be retained.

The merino sheep should be more closely adapted to intensified agriculture by selecting for fertility, early maturity and better conformation. The aim should also be to increase the prepotency of the merino by making more effective use of live-breeding. Select with a view to producing spinning wool and bear in mind that a ewe which lambs regularly may be more economical than one with low fertility but a higher wool production.

Feeding and Care.—Ruling prices for wool and mutton have been fixed on the basis of quality, and consequently good feeding and care will now be more profitable than ever before. Apart from the disastrous effect it exercises on soil and pasture, overstocking will not only reduce wool production per sheep and of the herd as a whole, but will reduce the tensile strength of wool to such an extent that the major part of the clip will not be marketable as spinning wool. In addition, slaughter animals will fail to attain prime condition. The farmer's aim should be the production of spinning wool as well as mutton of the best quality.

[*Continued on page 286.*

Mountain Fires.

Dr. J. T. R. Sim, Professor of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

EVERY year the beautiful mountains of the western Cape Province are ravaged by fire during the dry months of summer. Sometimes these fires are started by negligent campers or smokers; sometimes woodcutters or flower pickers may be responsible, but often they are intentionally lighted by farmers who desire to destroy the coarse vegetation so that their live-stock may graze on the burned

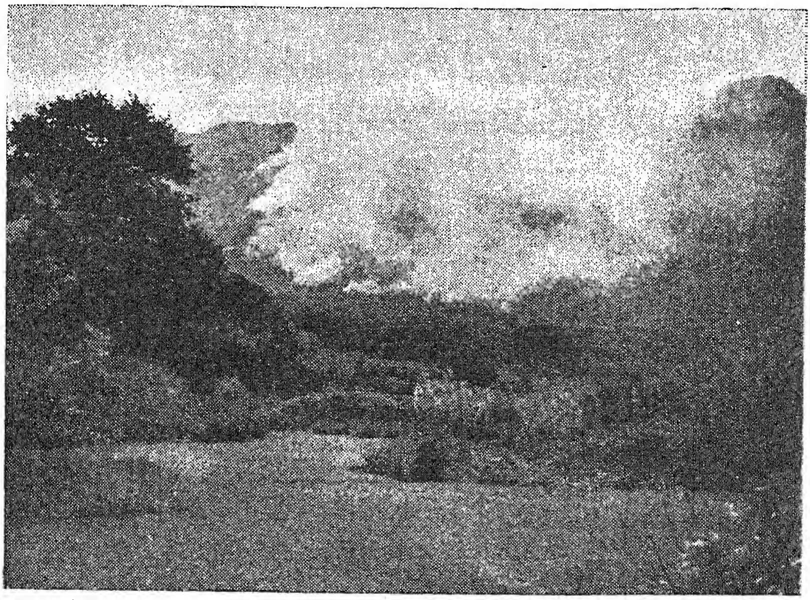


Fig. 1.—Fire in the mountains.
[*Photo: The Cape Times.*

over areas after the rains have fallen. But the burn is seldom confined to a farmer's own ground, for a fire once started is not easily put out, and more often than not hundreds of morgen of mountain country are laid waste before the fire is brought under control. The immediate damage done is great, but the consequences of the fire are even more disastrous.

Until recently the farming community has been rather apathetic about mountain fires and has generally accepted burning as a necessary practice for farmers owning mountain land. But the great damage from erosion and floods during the past two seasons has provided food for thought, and the realization is awakening that all is not well with the mountains. But things are really very much worse than they appear, and all members of the community must realize clearly that the mountains are in a very bad way indeed, so bad in fact that their condition is becoming a menace to the public welfare, and that corrective measures have to be taken without delay.

Function of Mountain Vegetation.

Let us examine what is actually happening in the mountains.

In the summer the mountains are burned and all vegetation

is destroyed. After the autumn rains a new growth of plants develops, but the stand is thin. Its feeding value is low and its carrying capacity poor. In consequence it is easily over-grazed and the stand becomes still further thinned out. All too frequently it is goats—the most destructive of domestic animals—which are grazed on the mountain veld, and these animals do great damage to the already sparse vegetation, causing many paths and bare patches of

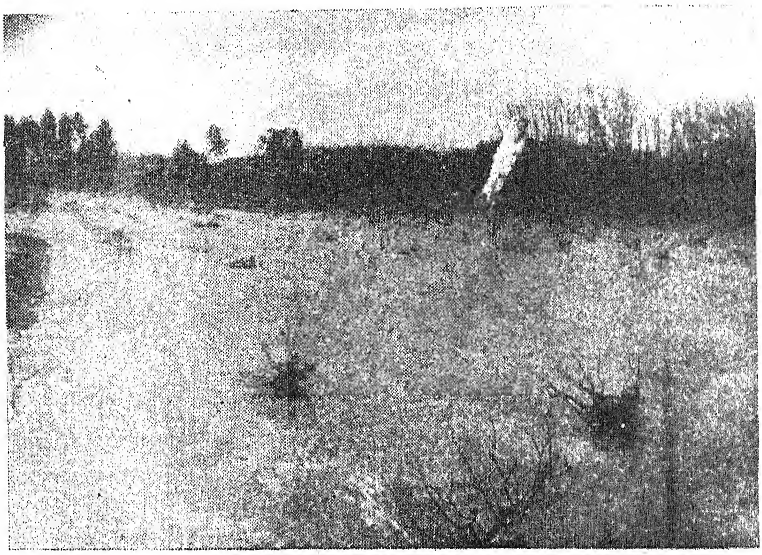


Fig. 2.—Floods in the orchard.
[*Photo: Dr. G. D. B. de Villiers.*

soil. This poor pasturage is the advantage gained from the mountain fire, but too few people truly appreciate at what cost it is obtained.

The natural protective cover of vegetation on the mountains is one of nature's provisions to ensure regular water supplies, and thus to keep a country habitable for man and beast. The mountains are the catchment areas of a country and its natural watersheds. To damage this vegetation is to weaken the nation's water supplies, to endanger its future prosperity, and to imperil its continued existence on its home soil.

Because of the vegetation—trees, bushes, shrubs, grasses—and the accumulation of fallen leaves and leaf mould, the rain water cannot easily run off, and it is absorbed into the soil or else quietly makes its way to the lower levels, where it reappears in the form of springs which give rise to streams and eventually to rivers, which provide perennial clear water supplies for use by the bulk of the population.

Damage Caused by Floods.

But when this protective plant cover is damaged by fire and by over-grazing, very little of the rain water sinks into the soil. Since there is no vegetation or leaf mould to impede its movement, the water runs off down the slope, and as its moves it gains velocity. The water moving at speed has an eroding action, and it cuts and tears into the soil, carrying much of it off in suspension. As it gains in force the water starts to carry heavier material, first light gravel,

then heavier gravel, then stones and finally boulders, and as these are carried with the stream they augment the eroding action of the water and gouge out more soil and stones as they go. (See accompanying photographs.)

The water reaches the lower levels in the form of raging torrents which quickly attain flood-water dimensions, and it rushes off in the watercourses on its journey to the sea. But often the riverbeds are too small to hold the huge quantities of flood-water, and the flooded rivers overflow their banks and rush over the valuable cultivated alluvial soils alongside. If the speed of the overflow is slowed down the water deposits on these lands quantities of the silt or sand which it has carried in suspension, to the extent that crops, vineyards and even orchards may be entirely buried. If the speed of the overflow water is not slowed down its force proceeds to erode the cultivated soils. In the last couple of years many cases have occurred in the western Cape Province where large areas of valuable orchards, vineyards and other lands contiguous to the rivers have been utterly destroyed or badly damaged. Huge losses are incurred, not only in the destruction of the crop plants, vines and trees, but also in the

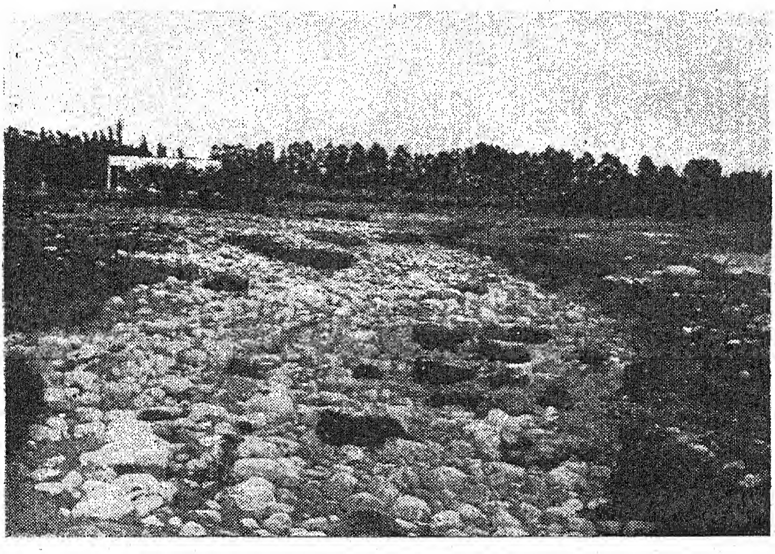


Fig. 3.—After the floods.
[*Photo: D. G. D. B. de Villiers.*

removal of valuable soil which can never be replaced. The irony of it is that these losses are incurred, not by the man who starts the fire, but by his fellow farmers lower down the river.

Thus the mountain fires are directly responsible for devastating floods, and in this dry country of ours enormous quantities of water race to the sea and are lost. When the floods subside and the rainy season is past the mountains soon become gaunt and dry. So little water has soaked into the remaining soil that the natural springs soon dry up and fail to feed the rivers, which, as the summer season proceeds, become lower and lower, until they can no longer provide the much-needed irrigation water, and finally even the domestic water supplies of the cities, towns and villages become seriously threatened.

Such a state of affairs cannot be tolerated, and prompt action must be taken to save the mountain vegetation and our water supplies *before it is too late.* The situation is deteriorating at a rapid rate, and the unprecedented floods which have occurred in the last two years will continue to occur each rainy season until the mountain vegetation is restored. But the vegetation cannot be restored while annual burning and over-grazing is permitted to continue. And even when these practices are stopped it will be a considerable time before a good cover of vegetation once again develops, for great damage has already been done by erosion and the best soil has been lost.

Title deeds may give to an owner the legal right to do with his property what he will, but the mountains—the sources of water—truly belong to the nation, and no one has the moral right to endanger the nation's water supply by burning the mountains. The mountains were never meant by Nature to be pastoral areas, and if live-stock cannot be kept there without burning, then it is the live-stock, and not the vegetation of the mountains which must go.

This question of mountain fires is a matter of vital importance for everyone, and each of us must contribute what he can towards the eradication of this evil.

We appeal to those who have legal title to the use of mountain ground to examine the situation carefully, to come to an appreciation of the dire consequences of mountain burning, and eventually to modify their farming systems so that the need for burning no longer exists. Let us face the facts squarely and realize that this must mean a radical reduction of the live-stock, particularly goats, on the mountain ranges—possibly their entire removal—and the provision of feed in other forms on the lower lands. But such a course is surely to be preferred to the possible expropriation of the mountains by the State, and banning of man and beast entirely from the mountains. The situation is critical, and unless voluntary action solves the problem drastic steps may yet have to be taken in the interests of the country.

But even with the fullest co-operation by those who own mountain land the danger of mountain fires breaking out unexpectedly will always exist, and steps will have to be taken to meet it. A scheme of protective measures to deal with sudden fires will have to be carefully worked out, and rigidly applied. A service of mountain rangers and fire watchers will probably have to be developed, as well as systems of fire belts from which to deal with fires. Farmers, municipalities and others living near the mountains can form Fire-Protection Associations or Vigilance Committees which will be prepared, on short notice, to rush men to any point where a fire has been reported, and to tackle and control the fire before it assumes dangerous proportions. All these measures, and many others as well, are going to be necessary if the precious water-sheds are to be preserved for future generations.

Sheep Farming in Time of War:— [*Continued from page 282.*

Handling of Wool.—A sheep-farmer who possesses the right type of sheep and with correct feeding and care, produces good spinning wool, may nevertheless suffer serious loss as a result of incorrect handling and classing of the clip. Badly classed clips are valued on a lower basis, and no farmer can afford the resulting loss. Every farmer must take this opportunity of good prices to pay his debts and ensure his own future.

The present high prices should also encourage farmers to make an effort to provide better grazing and feeding for their animals.

Reclamation of Rhenoster-Bush Veld.

N. L. Smit, Extension Officer, Riversdale.

ALTHOUGH the veld of the south-western districts of the Cape Province is to-day overrun with rhenoster-bush and very little grass is to be seen there, those parts of the Riversdale, Heidelberg and Swellendam districts south of the Langeberg are still known as the " Grassveld ". About a hundred years ago, the area between the Langeberg and the " strandveld " was entirely covered with

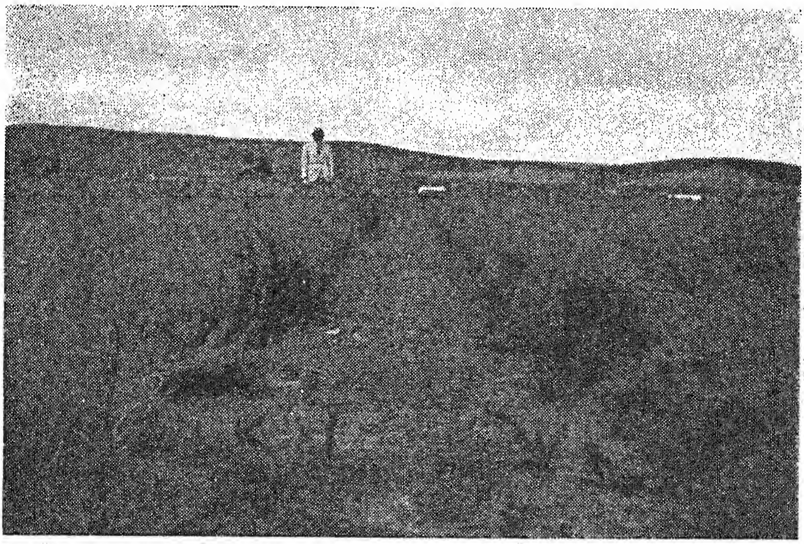


FIG. 1.—Stand of Rhenoster bush where experiments are carried out.

grass. Red-grass (*Themeda triandra*), known in this area as " blue grass ", predominated. With the extension of livestock-farming, especially sheep-farming, the grass cover gradually diminished owing to overgrazing and bad veld management, with the result that the rhenoster-bush was afforded an opportunity of gaining a foothold in this area. Farmers resorted to veldburning, and the general practice of grazing the burnt areas after the first rains had fallen, thereby allowing the young grass to be grazed down, only aggravated the evil. Consequently in the course of time, the rhenoster-bush vegetation became denser and denser. Ultimately the veld deteriorated to such an extent that the average rhenoster-bush veld cannot carry one sheep on three morgen to-day.

How to Improve the Position.

The basic principle for the reclamation of such veld is to eliminate the competition of this bush by eradicating it. After that the veld should be rested to enable the grass to grow and in this way to prevent the re-growth of the rhenoster-bush.

In order to determine the best way of reclaiming veld, an experimental plot was laid down in September 1939, and the following treatments were applied:—

(1) *Burning*: (*a*) in winter (July), (*b*) in summer when the veld is dry, and (*c*) in summer after good rains have fallen and when the veld is wet.

(2) Removing the bushes by means of a heavy drag made from rails.

(3) Cutting down the bushes by means of a disc-plough so as to disturb the surface of the soil as little as possible.

During all the treatments red-grass seed (*Themeda triandra*) and also Rhodes-grass seed, where dragging and cutting were resorted to, was sown.

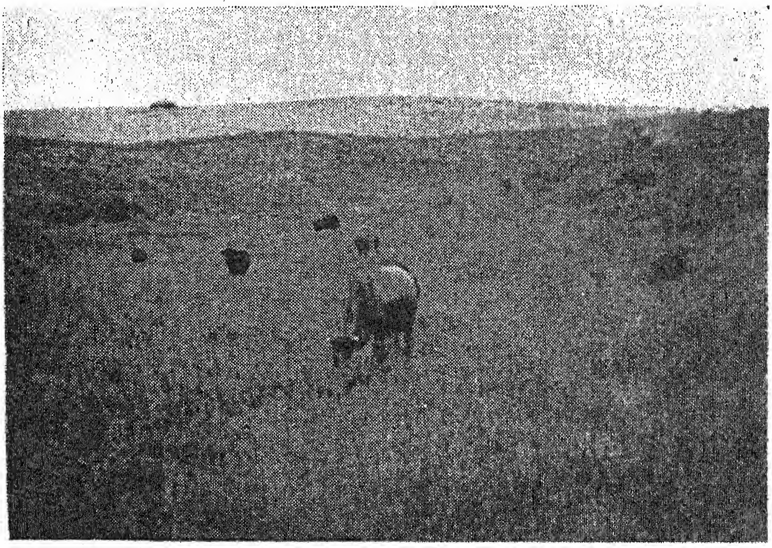


FIG. 2.—Good stand of *Themeda triandra* (red or blue grass) after the pasture had been rested for two consecutive years from March to December.

Although the experiment has not yet been concluded, the preliminary results are briefly discussed here so that they might serve as a guide for reclamation work.

(*a*) Plots, which were cut with a disc-plough, have in all instances yielded the best results. A good cover of various veld grasses immediately sprang up and the best stands of *Themeda triandra* and Rhodes-grass which had been sown, were obtained on these plots.

(*b*) Dragged plots ranked second in all respects, except for the fact that Rhodes-grass did not yield a very good stand.

(*c*) Next followed the method of burning in summer after rain has fallen. There is a striking difference between veld-burning in summer when it is dry and in summer after rains have fallen. The latter practice yields better results.

Recommendations.

In view of these results, the following preliminary recommendations are made:—

(1) *Veldburning.*—This is by far the cheapest method, but should be resorted to after good rains have fallen, at any time during the period January to March. The best germination of *Themeda triandra* seed in this area is usually obtained from March to May and, since the weather is also cool at this time of the year, there is little danger of the young and tender plants shrivelling up. The burning of wet veld may be facilitated in the following way: wind

a 12-inch wide strip of sacking into a tight roll and soak this in paraffin. Attach the roll to one end of a firm wire, the other end being tied to a blunt whip-stick or similar rod.. This will considerably facilitate the task of the fire-lighter, since the brand will burn for a long time and the use of the long stick will not expose the fire-lighter so much to the heat of the flames.

Veld-burning is recommended for areas where growth conditions are favourable and where *Themeda triandra* is still found. In the area between Swellendam and Heidelberg considerable success has already been achieved at various places with this method.

(2) *Dragging and Cutting.*—Under less favourable conditions as for example, where the soil is hard and the rainfall low, better results will be obtained by removing the weeds with a drag or by cutting them down. The work may be done in summer when the veld is wet. The weeds should be left on the veld after cutting or dragging so that they might serve as a cover for the soil and protect the young grasses. If the veld has been entirely denuded of *Themeda triandra,* seed should be sown. This can be done either by the seed-in-clay method or by scattering the grass ears over the veld. Seed cannot now be bought, however, and the farmer should fence in a damp kloof on his farm, rest it, and gather the seed crop annually.

(3) *Resting the Veld.*—Whatever method is adopted, such veld should be rested for the first few years so as to allow the grass to run to seed. The dry grass, however, may be grazed off by cattle, but until the stand of grass is dense enough, it is better to exclude sheep from the grazing. In the meantime an adequate amount of Rhodes-grass or dry-land lucerne may be sown to serve as grazing until the first veld camp has been reclaimed. Thereafter the work of reclamation will be easy.

A sufficient number of camps are essential in order to apply a system of rotational grazing for the reclamation and maintenance of the veld. Rhodes-grass sown in a veld camp is preferred by animals to *Themeda triandra,* and consequently the veld is also preserved in this manner, provided, however, that such a camp is not grazed too severely. Arable hilltops which provide little natural grazing, may also be ploughed for the purpose, and it has also been found that Rhodes-grass grows extremely well on such virgin soil.

Labour:— [*Continued from page 281.*

the farm, with a view to securing a better distribution of labour throughout the year. The labour available should be kept fully and effectively occupied during the whole of the year. By keeping pace with changes in the prices obtained for produce, labour can be used more effectively. The necessary adjustment in farming operations should be effected by producing the more profitable product (i.e. those for which a keener demand exists) and eliminating those which yield either small profit or no profit. If this is not done, labour is wasted, either because the price tendencies are not utilized to their full extent or because labour is not used most profitably throughout the year. Consequently the farmer must not only endeavour to combine the most profitable branches of farming, but should combine them in most profitable branches of farming, but should combine them in such a way as to secure the greatest profit on the year's labour. It is not an easy matter to ensure a regular distribution of labour throughout the matter to ensure a regular distribution of labour throughout the year, as can be concluded from the fact that very few farmers succeed in this direction. As a rule, there is a serious gap between available and effective labour.

Compost in the Town Garden.

I. S. Perold, Professional Officer (Agricultural Chemistry),
Stellenbosch-Elsenburg College of Agriculture.

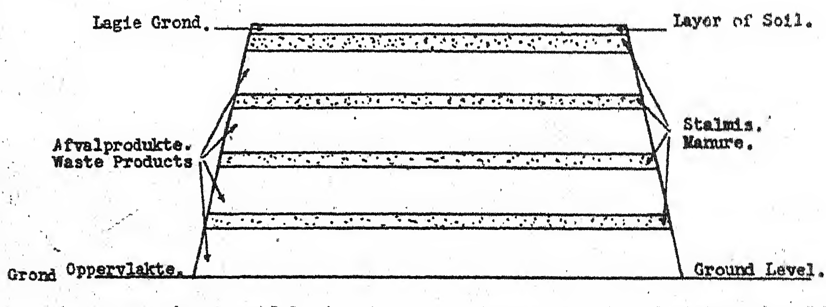
IN South Africa, as in most other countries, we find that most town dwellers and even many city dwellers keep a vegetable or flower garden. These people find it difficult, however, to keep their gardens going owing to the shortage of fertilizers and the increased use of stable manure by farmers. They can, however, provide their own fertilizer requirements by making their own compost. The method employed is really very simple and can be carried out by anyone at very little cost.

The materials which may be used include hedge and lawn clippings, vegetable waste (leaves and peelings), leaves of trees, wilted flowers and other organic waste products. Since the compost heap will be relatively small it would be advisable to cut coarse material such as cabbage stalks and large branches beforehand into small pieces. This will accelerate the process of decomposition.

The second requirement in the making of compost is the micro-organisms which are responsible for the decomposition of the organic material. The best and cheapest source of such bacteria is ordinary stable manure and it will be seen from the following description that very little manure is required.

Stacking the Compost Heap.

The accompanying sketch shows how the different layers of the compost heap should be stacked.



A convenient width is 4 to 5 feet and the height should preferably not exceed 3 to 4 feet; the length will depend upon the quantity of waste material available. The thickness of the layers of waste material and manure should be approximately 8 inches and 1½ inches, respectively. The layer of soil on top should be about 1 inch thick and serves to retain the valuable gases which may otherwise escape. If wood ash—not coal ash—is available, small quantities can be spread on each layer of waste material before the manure is added.

The rapid decomposition of the waste products can take place only if there is sufficient air and moisture in the heap and care should, therefore, be taken to ensure that nobody stands on or walks over the heap. The different layers should be soaked as they are laid down and subsequently the stack must be watered from time to time. Instead of the different layers being watered during the process of building up the heap, strawy and very coarse material can be soaked in water before being stacked.

[Continued on page 294.

Veld Management and Fodder Production in the North-western Cape.

F. H. Theron, Extension Officer, Calvinia.

THE rainfall in the north-western Cape Province is relatively low and irregular, and the possibility of periodic droughts must always be taken into account. Where no precautionary measures are adopted, stock losses will inevitably be suffered, the grazing will be destroyed by trampling, and the value of the farm will decrease.

In spite of this the necessity for storing fodder reserves is not generally realized. This is proved by the serious state of affairs

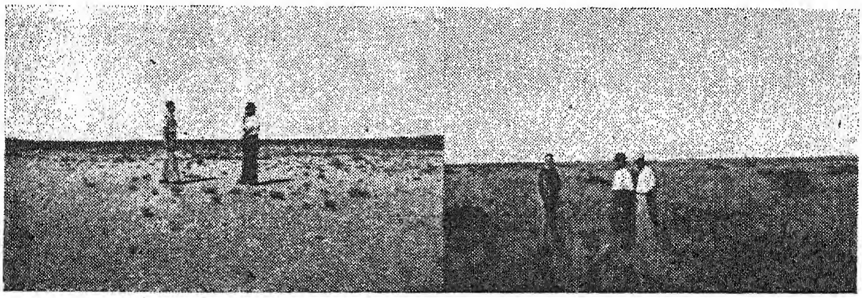


FIG. 1.—Two neighbouring farms in Boesmanland. Left: A good example of over-grazing. Right: The meaning of veldmanagement. Note the Bushman grass.

which prevailed immediately after the recent drought in the north-western Cape Province. Once again serious losses were suffered and many farmers had to move their stock.

Over-capitalization of Farms.—The various causes of soil erosion and pasture deterioration cannot be enumerated here again since they are all well known and in many cases energetic counter measures are now being applied.

Over-capitalization of farms still remains one of the main obstacles in the way of recovery, however. In order to meet his obligations the stock farmer only too frequently resorts to the most obvious means at his disposal, viz., an increase in the number of his stock. In this way he hopes to discharge his debts and after that has been done, attention will again be paid to the condition of the farm. As can be expected, such a policy usually ends in disaster, since it is merely a form of gambling. The final result is generally a decline in the carrying capacity of the veld owing to over-grazing while stock losses increase and the income decreases.

A Sound Policy.

The only sound farming policy for this area is one that aims at increasing the productivity of the farm. This can be done as follows:— (1) By improving the quality of the stock, (2) by improving the grazing, (3) by growing fodder crops and by building up fodder reserves.

(1) *Improvement in the quality of the stock can be accomplished by using good rams.*—According to the 1939 census the average wool yield for the Cape Province was only 6·8 lb. per sheep. In the case of many flocks the average yield is as low as 5 lb. There is thus much room for improvement. It is possible to increase its yield to

at least 10 lb. per sheep within a few years by using better rams and by retaining only the good ewes in the flock.

Suppose a farmer keeps 2,000 merinos whose average wool yield is 6 lb. per sheep, and that he succeeds in increasing the average yield to 10 lb. per sheep by using good rams. Calculated at 12 pence per lb. for the wool this would mean an increase in income of 4s. per sheep or £400 on the whole flock.

A ram has a very big influence on the flock, since one ram has such a large progeny. It therefore follows that the extra capital

Fig. 2.—The second growth of a fine patch of lucerne belonging to Mr. H. Nel, Bo-Downes, after a heavy winter irrigation in a "saaidam".

invested in a good ram is relatively small compared with the benefit gained. The wool yield will remain the same or may even be higher if a smaller number of good animals are kept instead of a large number of inferior animals. In addition, the grazing will not be exposed to over-grazing and the danger of losses during a drought will be considerably lessened.

(2) *Improving the grazing.*—Owing to the topography and the nature of the soils of the north-western Cape Province, sloot or donga erosion very seldom occurs in that area. Surface erosion due to the action of wind or water, is most common here. Farmers are usually eager to build storage dams for irrigation purposes but this does not eliminate the root cause of the trouble. It would be more advantageous in the long run to keep rain water on the veld and to restore the natural vegetal cover of the soil. This can be achieved (*a*) by resting the veld, (*b*) by the artificial dissemination of seed, and (*c*) by constructing contour embankments.

(*a*) *Resting the Veld.*—This does not mean that the veld should not be used for grazing for a number of years, but that the so-called deferred or rotational system of grazing should be followed. This system is best described in Prof. A. M. Bosman's description in "Cattle Farming in South Africa" viz.:—

(1) An over-grazed area sufficiently large to supply feed from the time of seed maturity until the end of the grazing season, is protected from stock until the seed crop has matured.

(2) Upon maturity of the seed crop, the veld is grazed.

(3) The same area is protected for the same period during the second season until the new seedlings have been thoroughly established.

(4) When the area has been satisfactorily re-seeded it is grazed early in the season so that a second area can be protected in the same way.

(5) By persisting with this grazing system even after the overgrazed portions have been fully revegetated, the vegetation will not only remain vigorous at all times but the formation of an occasional seed crop will also be made possible.

(b) *Use small seed paddocks for distributing seed.*—In the Karroo where the paddocks are very large, it would be desirable to facilitate the dissemination of seed by fencing off small areas of about one morgen at well-placed points throughout the larger paddocks. Suitable grasses and shrubs can then be cultivated in these small areas from where the seed will spread over the rest of the veld.

(c) *Contour embankments.*—On level surfaces where surface erosion is already far advanced and the veld has been denuded of vegetation, contour embankments can be made to check the water

FIG. 3.—A patch of soybeans in a "saaidam" at Zak River. Ploughed and planted after a heavy irrigation in October. It had received no subsequent rain or irrigation.

and to provide anchorage for the seed. The contour walls are made more or less parallel to one another and approximately 50 to 100 yards apart according to circumstances and from 1 to 2 feet high. Openings are left at suitable places in the embankments in order to facilitate a better distribution of the water over the veld.

Grow Fodder Crops and Build Up Fodder Reserves.

Not only are fodder reserves a safeguard against drought, but they also help to increase the carrying capacity of farms on which sufficient fodder can be produced.

The most important fodder crops that should be considered in this area are winter cereals and lucerne, but even Sudan grass and soybeans have been grown with success as a hay crop under the "saaidam" system.

In the winter rainfall area of the north-western Cape Province it is still the usual practice to sow winter cereals under dryland cultivation or under the "saaidam" system. Although good yields

are sometimes obtained, grain production is often a failure. The result is that not only is fodder-crop production neglected, but that much valuable veld is destroyed in order to make room for arable lands. Winter cereals can be sown successfully as a pasture crop on the shallower dry soils. On the deeper alluvial soils, however, lucerne should be given preference.

Lucerne can withstand long periods of drought if it is not overgrazed, since it is a perennal with a deep root system. It can also make better use of one heavy irrigation than other cereals with a shallower root system. In the Calvinia district it was found that lucerne will produce at least $1\frac{1}{2}$ loads of hay after one heavy winter irrigation on deep alluvial soil, while $2\frac{1}{2}$ loads hay are obtained with one heavy summer irrigation on the same soil. Dryland lucerne will always provide good pasturage and a hay yield as well during favourable years.

Sowing time for lucerne.—Where permanent irrigation is possible, lucerne can be sown with very little trouble at practically any time of the year. In those parts with a low winter rainfall, as in the winter-rainfall area of the north-western Cape Province, the best time for sowing lucerne appears to be during the autumn months.

Dryland lucerne then germinates after the first rains and develops a deep root system during winter so that it can withstand the dry summer. In the case of "saaidamme" it is better to wait for the first water before ploughing and sowing.

Sowing method.—For dryland lucerne the soil should be ploughed and harrowed to a fine tilth the previous season. Sloping ground should first be provided with contour embankments. Just before sowing time the soil should again be harrowed and the seed lightly covered with a harrow after it has been sown.

If lucerne is sown in "saaidamme" the soil should be well soaked with the first winter rains. As soon as the soil is dry enough for cultivation, it is ploughed and harrowed until it is fine. The seed is then sown and harrowed or rolled in. If the seed is sown before the water arrives, the soil will crack and the hard crust will hamper germination.

Treatment of established lucerne and cultivation of the soil.—Lucerne is an excellent pasture crop, but it is essential that it should be grazed judiciously. Annual lucerne should be grazed very lightly or not at all. Old established lucerne should also be grazed very moderately. The plants can easily be damaged, especially during long periods of drought. Dryland lucerne is particularly liable to damage by incorrect treatment. Where lucerne is grazed at frequent intervals it is necessary to break up the hard crust at least once a season so that water can be absorbed more readily. A sharp-tined cultivator can be used with good effect for this purpose.

Compost in the Town Garden:— [*Continued from page 290.*

Turning the Heap.

If all the requirements are fulfilled, a compost heap should begin to generate heat within the first 24 hours, and will remain warm for several weeks.

After about a month, however, it will begin to cool down and should then be turned with a stable fork in such a way that the different layers are thoroughly mixed. After the heap has been watered, its temperature will again rise as before. The compost should be ready for use after 3 or 4 turnings.

Cowpea-Hay Meal in Chicken Rations.

P. J. Serfontein, Professional Officer (Poultry), Potchefstroom College of Agriculture.

LUCERNE meal is in general use to-day in poultry rations, and constitutes from 5 to 10 per cent. of the mash.

The more poultry feed the farmer can successfully grow on the farm, the more economically will he be able to produce eggs and table poultry. These feeds should include some legume or other to provide the protein portion of the ration. Consequently an experi-

Fig. 1.—Group 1 at age of ten weeks, fed on cowpea-hay meal with eight per cent. lucerne meal.

ment has been commenced on the Potchefstroom Experiment Farm to ascertain whether cowpea-hay meal is a suitable substitute for lucerne meal in chicken rations.

Cowpeas are indigenous and are well adapted to a large variety of soil and climatic conditions. Owing to their high resistance to drought, cowpeas are particularly valuable in areas with a low rainfall. With the exception of a few localities, all areas in which maize is successfully cultivated are suitable for cowpeas. Since maize constitutes 50 per cent. and more, of poultry rations, the maize-growing areas are also the areas where poultry-farming can be carried on most economically in all circumstances. It would, therefore, be advisable to find another home-grown product for supplementing the rations in these areas.

Formerly lucerne meal was included in poultry rations whenever green feed was not available to furnish vitamin A. At present, however, the chief object of adding lucerne meal to rations containing yellow maize and green feed, is to supplement certain vitamins of the B2 complex. Most important of these are riboflavin and pantothenic acid. Lucerne meal is a valuable source of the former and contains reasonable quantities of the latter as wel as a few lesser-known vitamins of minor importance.

Obviously, therefore, if cowpea-hay meal is to replace lucerne meal in poultry rations, it must to a reasonable extent, possess the same qualities as lucerne meal. Consequently a comparative experiment was conducted with these two crops in meal form.

Nature of the Experiment.

The cowpea meal was made from plants grown at this institution. These plants were cut in the early pod stage, and dried in the sun.

Care was taken not to injure the leafy portion of the plants in any respect, and the hay was kept in a lean-to shed for four months, after which it was ground in a hammer-mill. The final product was a meal with a deep green colour, and must be regarded as a first-grade product. The lucerne meal used in the control group, was purchased on the open market and may be described as a reasonably good specimen. The analysis of the two products is given in Table I.

TABLE I.—*Analysis of Cowpea-hay Meal and Lucerne-hay Meal.*

	Cowpea-hay Meal.	Lucerne-hay Meal.
	Per Cent.	Per Cent.
Proteins	18·35	16·000
Phosphate (P)	0·107	0·200
Calcium (Ca)	1·920	1·230
Fibre	15·700	27·300

The reason for the low fibre content of the cowpea-hay meal, is that the top portion of the stack was removed before the portion used for experimental purposes was ground. During the process of removal, a large number of leaves were left behind and the fibre content of these is very much lower than that of the stems.

The feeding experiment was commenced on 13 August, 1942, with 250 Black Australorp chicks, divided into 5 groups of 50 each. From the first day and until they were 4 weeks old, the chicks were kept in an electric battery brooder, where each group received separate heating in its compartment. During this period they were fed cod-liver oil, as indicated in Table II. After the fourth week the chicks were moved to chicken-houses measuring 10 ft. by 2 ft., each with a cement run. These houses were not provided with artificial heating. No green feed was fed during the 10 weeks that the chicks were under the experiment. The rations fed are indicated in Table 2.

TABLE II.—*Rations Fed from Age of 1 day to 10 weeks.*

	Groups.				
	1.	2.	3.	4.	5.
	lb.	lb.	lb.	lb.	lb.
Yellow mealiemeal	52	52¼	49¼	49	48¾
Wheaten bran	10	10	10	10	7
Oatmeal	10	10	10	7	7
Lucerne meal	8	—	—	—	—
Cowpea-hay meal	—	8	12	16	20
*Concentra fish meal and meat and bone-meal	18	17¾	17	16	15
Powdered Oyster Shell	½	½	¼	—	—
Bonemeal	—	—	—	½	¾
Salt	½	½	½	½	½
Cod-liver oil	1	1	1	1	1
Manganese sulphate	½ oz.	½ oz.	½ oz.	½ oz.	½ oz.

*Concentra fish-meal with an analysis of 65·5 per cent. protein, and fish and bonemeal with a protein content of 55 per cent. were mixed in the proportion of 3 : 1.

Table III.—*The Composition of the Rations was Calculated as follows*:—

	Groups.				
	1.	2.	3.	4.	5.
Crude Protein	19·78	19·81	19·82	19·73	19·65
Calcium	1·57	1·61	1·54	1·56	1·63
Phosphorus	1·02	1·00	1·00	1·01	1·00
Crude Fibre	4·83	4·01	4·65	5·00	5·48

Fig. 2.—Group 2 at age of ten weeks, fed on cowpea-hay meal with eight per cent. cowpea-hay meal.

Results.

Table IV.—*Average Weight and Feed Consumption per Chick at the Ages of 4, 8 and 10 Weeks, respectively.*

Groups.	Fourth Week.			Eigth Week.			Tenth Week.		
	Cockerels.	Pullets.	Feed Consumption.	Cockerels.	Pullets.	Feed Consumption.	Cockerels.	Pullets.	Feed Consumption.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	0·42	0·41	0·67	1·27	1·21	3·70	1·99	1·73	5·71
2	0·49	0·43	0·78	1·41	1·25	3·90	2.18	1·88	6·25
3	0·40	0·40	0·76	1·22	1·17	3·59	1·85	1·74	5·71
4	0·41	0·40	0·73	1·21	1·14	3·80	1·97	1·74	5·75
5	0·35	0·31	0·66	1·23	0·97	3·12	1·81	1·41	5·51

The chicks were examined every week for signs of a nutritional deficiency, such as paralysis of the legs (caused by a flavin deficiency), sores in the beak and under the feet (caused by a pantothenic acid deficiency), and perosis, which develops as a result of manganese deficiency. In addition, regular observations were made of feather-growth, feather-eating and cannibalism.

It is noteworthy that all the deaths occurred before the fourth week, the majority having taken place during the second and third weeks. All the chicks which died showed signs of a pantothenic acid

deficiency, which was undoubtedly the cause of the deaths. The addition of 3 per cent. molasses to the ration will prevent the appearance of these symptoms and the resultant deaths.

TABLE V.—*Mortality up to the Age of 10 Weeks.*

Groups.	Percentage Mortality.			
	Fourth Week.	Eigth Week.	Tenth Week.	Total.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1....................	20	20	20	20
2....................	16	16	16	16
3....................	6	6	6	6
4....................	6	6	6	6
5....................	8	8	8	8

TABLE VI.

Groups.	Flavin Deficiency.	Pantothenic Acid Deficiency.	Perosis.	Cannibalism.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1....................	6	26	12	2
2....................	6	17	12	—
3....................	—	8	2	—
4....................	—	6	—	—
5....................	—	8	—	—

In Table IV the average weight and feed consumption of chicks at the ages of 4, 8 and 10 weeks are given. The weights of all the groups must be regarded as very satisfactory. The feed consumption of Group 2 was the highest, and, as may be expected, the weights of the chicks in this group were also highest. The fibre content of the ration of this group was the lowest. The superior results obtained in Group 2 as compared with Group 1, may be ascribed to the fact that the cowpea meal contained a larger percentage of leaves, which are not only lower in fibre, but have a higher riboflavin content. Even in Groups 3 and 4, where the percentage of cowpea meal was as high as 12 and 16 per cent., respectively, the increase in weight was reasonably good. On ration V, however, which had a cowpea-hay meal content of 20 per cent., the pullets made poor growth.

From Table V it can be seen that in most cases a deficiency of flavin and of pantothenic acid and the occurrence of perosis was noted in Group 1, where lucerne meal was fed. As the latter was replaced by cowpea-hay meal and the percentage was increased, as indicated in table II, these deficiencies decreased. The improvement in the growth of Group 2 as compared with that of Group 1 in Table V must partially be ascribed to the fact that the cowpea-hay meal contained more leaves and consequently more riboflavin than the lucerne-hay meal.

Although manganese was provided to all five groups in the form of manganese sulphate, cases of perosis nevertheless occurred. The highest percentage of cases occurred where 8 per cent. lucerne meal was fed in Group 1 and the second highest in Group 2, where the same quantity of cowpea-hay meal was fed. As the cowpea-hay meal was increased to 12 per cent., the incidence of perosis decreased, and when 16 and 20 per cent., respectively, were included, perosis was completely absent.

In all the groups the chicks were well covered with feathers at the age of ten weeks, although Groups 4 and 5, and particularly Group 5, were poorly covered at the age of eight weeks. From the eighth to the tenth week the feathers of the latter two groups made remarkably rapid growth. The chicks of Group 1 which were fed on lucerne meal, did not have the lustrous and oily appearance which was characteristic of the cowpea-hay meal groups.

Conclusions.

The above results lead us to the following conclusions:—

(1) Cowpea-hay meal can replace lucerne meal in chicken rations and can be advantageously used on farms where cowpeas are cultivated. The percentage recommended will depend upon the percentage of leaves present. As in the case of lucerne meal, however, from 8 to 10 per cent. may be accepted as an average.

Fig. 3.—Group 5 at age of ten weeks, fed on cowpea-hay meal with 20 per cent. cowpea-hay meal.

(2) As in the case of lucerne meal, the flavin and pantothenic acid content of cowpea-hay meal, which is just as important as its vitamin A content, will depend upon the stage of cutting, method of drying and percentage of leaves present in the hay when it is ground.

(3) That the nutritive value of our poultry rations can be appreciably increased if more attention is paid to the preparation of the lucerne meal and also the cowpea-hay meal used in the mash. An important reason, therefore, why cowpea-hay meal should be given preference above lucerne meal on farms where cowpeas are cultivated, is that it is possible to ensure that the plants are cut at the correct stage, are properly dried and that as few leaves as possible are lost.

If possible, the farmer can even go to the length of eliminating the coarser stems and grinding only the leaves and finer portions. The stems can then be fed to larger animals.

(4) Since the chief value of lucerne meal and cowpea-hay meal as poultry feeds lies in their vitamin A, riboflavin and pantothenic acid content, it is clear that there is an urgent need of lucerne-leaf meal and cowpea-leaf meal. If these two products were available, it would be possible to improve poultry rations to a considerable extent.

Care of Farm Machinery.

M. C. Burt, Senior Professional Officer, Stellenbosch-Elsenburg College of Agriculture.

FROM the preliminary preparation of the soil to the carrying of crops to market most of the operations are performed with the aid of machinery. If the machines fail at any stage the final results are impaired. Indifferent cultivation and drilling and delays in harvesting cause losses which can never be regained. Often, owing to delay in being overhauled, a machine begins to function correctly only when its seasonal work is nearing completion.

When a machine is taken out to work it must be in a good state of repair and correctly adjusted. Repairs and adjustments should be carried out while the machine is standing idle. While it is in service running repairs and adjustments must be carried out immediately. Neglect of a small break or wrong adjustment may lead to poor work and in some cases to a serious derangement of the machinery.

In many cases repairs may be done quickly, but it is of the first importance to see that the machine is correctly adjusted in order to function efficiently. Farmers should make themselves fully conversant with the adjustments of the various implements and machines they use. Manufacturers of machinery issue catalogues and pamphlets on the use of their machines, and several good books have been published on farm machinery. Every farmer should keep these pamphlets and books at hand for reference, so that he may obtain the best work from his machinery. Very often a machine is left in a corner of the field in which it was used last and receives no attention until it is required again. Most farm implements and machinery are rigidly built, but if they are mishandled and neglected they depreciate rapidly. The result is that poor work is done and draught is increased with greater consumption of fuel.

Protection and Repairs.

To prolong the life of machinery it should be kept under cover. The implement shed need not necessarily be an expensive structure. A simple shed with a lean-to or flat roof is all that is required and the shed should be oriented so that it keeps out rain and sun. It should be large enough to accommodate all the implements and machinery used on the farm. The floor of the shed may be of gravel, which has been well rammed or rolled, and it should be well drained. A small workshop in or attached to the shed will facilitate repairs. The workshop should be equipped with a stout bench, heavy vice, set of tools, an anvil and a small forge.

When implements are put away after use they should be cleaned and any bright surfaces should be given a coat of grease or waste oil. A note of any repairs required should be made on a tag which is tied to the machine. These repairs may be carried out on rainy days or during slack periods on the farm. An occasional coating of paint helps to keep metal parts from rusting and wooden parts from decaying.

In normal times much loss is incurred through the neglect of machinery, and the facility with which new parts may be obtained fosters this neglect, but under present conditions it is difficult and in some cases impossible to obtain spare parts. Therefore it behoves the farmer to overhaul his machinery systematically and use it carefully and intelligently so that production may not be impaired.

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 APRIL 1943 No. 248

CONTENTS

* Price Review for February, 1943.

SLAUGHTER CATTLE.—A further decline in prices of slaughter cattle occurred on all markets during the month. During the first half of the month prices remained firm, but a weakening in quality then set in, causing prices to drop. Ordinary primes on the Johannesburg market declined from 62s. 10d. per 100 lb. estimated dressed weight *on the hoof* to 60s. 11d. in February, good mediums from 57s. 2d. to 55s. 8d. and compounds from 47s. 10d. to 44s. 5d. On the Durban market No. 3 declined from 45s. 6d. to 43s. 11d. per 100 lb. dressed weight *on the hook* and undergrade from 37s. to 34s. 6d.

Slaughter Sheep.—A fairly large supply, nearly half as much as that of the previous month and with inferior qualities predominating caused prices to weaken all round. Prime merinos were 10·5d. per lb. estimated dressed weight in February as against 11·2d. in January and prime crossbreds on the Cape Town market were 10·1d. as against 10·4d. per lb.

Feedstuffs.—All feeds remained very scarce and dear. Kaffircorn averaged 34s. 2d. per bag f.o.r. for K1 and K2. Lucerne hay was abundant at the beginning of the month, but supplies gradually diminished. A large percentage inferior hay was again present. Average prices for Cape and Transvaal lucerne hay on the Johannesburg market were respectively 5s. and 6s. 6d. per 100 lb. Oats and teff hay were exceptionally scarce and easily realised the fixed maximum prices.

Potatoes.—Markets were still heavily supplied, while large supplies were carried over daily. Towards the end of the month Transvaal potatoes were well represented on all markets while locally produced potatoes began to diminish. Some markets showed a slight improvement in prices as against the previous month. On the

* All prices mentioned are average.

Johannesburg market, e.g., Transvaal No. 1 rose from 7s. 9d. per bag in January to 8s. 3d. in February, and N.M. Grade 1 Nos. 2 and 3 from 10s. 9d. and 10s. 8d. to 11s. 8d. and 11s. 6d. respectively. On the Cape Town market the supply was somewhat bigger than for the previous month and prices declined further, e.g., Cape No. 1 from 10s. 9d. to 8s. 4d. per bag in February.

Onions.—Bigger supplies towards the end of the month caused prices in some markets to weaken somewhat. Transvaal onions on the Johannesburg market were 7s. 10d. per bag as against 8s. 5d. the previous month, while Cape Onions on the Cape Town market were 7s. 3d. as against 7s. 8d.

Tomatoes.—Fairly large supplies reached the markets, but the quality was much poorer. Consequently prices declined fairly sharply on some markets, e.g., on the Cape Town market from 2s. 6d. to 1s. 8d. per tray in February. On the Johannesburg market prices remained firm, N.M. No. 1 was 5s. 5d. per tray and ordinary tomatoes 2s. 7d.

Vegetables.—On the Johannesburg and Pretoria markets supplies of cabbages, pumpkins, greenpeas and carrots were abundant. Especially in the case of pumpkins, the markets were dumped practically every day and prices hereof were as a result low. On the Cape Town market the supply was on the whole bigger than for the previous month especially of pumpkin varieties, carrots and beetroot. Nevertheless the same high price level of the previous month was maintained. On the Port Elizabeth and East London markets, all vegetable varieties were exceptionally scarce and dear as a result of the severe drought during the month which adversely affected local production. Few consignments were also received from elsewhere.

Fruit.—Offerings of apples and pears increased considerably. Especially Bon Cretien pears were exceptionally well supplied. Good qualities realised excellent prices. Supplies of peaches from Western Province began to diminish. On the Johannesburg and Pretoria markets Transvaal Yellow peaches were, however, present in large quantities but were not very popular with buyers, and were mostly of poor quality. Consignments of grapes were heavy. Offerings in trays sold generally well, but sales of bushel baskets were weak. Taking the large quantities into consideration, the price level was maintained on a satisfactory level. The average price for trays on the Johannesburg market for February was 1s. 5d. as against 1s. 6d. the corresponding month for the previous season. Watermelons and spanspecks were much less although large offerings on the Cape Town market dominated this market to the detriment of other products. Good qualities Cape watermelons sold at high prices everywhere. The supply of pineapples was very heavy, e.g., on the Johannesburg market 72,931 dozen were offered as against 33,950 dozen in January. The demand was good, but prices nevertheless dropped. Moderate consignments oranges sold at very high prices. Valencias and seedlings decreased considerably, while supplies of navals increased.

Eggs.—Supplies were much less than the previous month and prices sharply increased everywhere. On the Johannesburg market, e.g., new laid rose from 1s. 8d. to 2s. 3d. per dozen in February and fresh eggs from 1s. 4d. to 1s. 11d. While on the Cape Town market eggs rose from 13s. 11d. to 16s. 7d. per 100 lb.

Index of Prices of Field Crops and Animal Products.

This index as appears from the table elsewhere in this issue only advanced one point during the month, viz., from 141 to 142 in February.

An increase occurred in the group "Summer Cereals", viz., from 160 in January to 163 in February. This increase was caused by the rise in the price of kaffircorn, viz., from 27s. 3d. per bag f.o.r. for K1 and K2 in January to 34s. 2d. per bag in February. The group "Poultry and Poultry Products" is the only group showing an appreciable increase, viz., from 150 to 179 in February. This was as a result of the sharp increase in prices of eggs during the month under review. "Slaughter Stock" is the only group of which the index declined during the month, viz., from 165 to 156.

The other groups of products all changed very little or nothing.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON (1st July to 30th June).	Summer Cereals, (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Products. (e)	Dairy Products. (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936-37	118	86	94	93	122	86	89	98	106
1937-38	89	106	112	118	98	112	105	107	101
1938-39	92	107	96	89	79	102	106	94	93
1939-40	86	106	77	93	116	105	106	89	104
1940-41	109	113	106	159	103	108	110	112	109
1941-42	121	132	145	205	101	131	134	163	124
1942—									
January	131	137	126	180	100	122	144	141	125
February	132	138	125	168	101	130	140	147	125
March	126	140	140	175	101	130	134	168	125
April	126	139	151	170	102	130	129	175	125
May	158	139	188	181	102	154	132	203	136
June	159	139	207	186	101	154	140	218	138
July	159	140	183	184	166	167	154	163	143
August	159	139	181	175	115	167	155	130	140
September	159	139	182	191	115	167	176	133	145
October	159	139	156	227	115	167	181	141	147
November	160	154	134	189	115	139	187	146	147
Desember	160	154	123	137	115	139	178	158	144
1943—									
January	160	154	132	113	115	139	165	150	141
February	163	154	130	112*	115	139	156	179*	142*

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay.
(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins.
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls, turkeys and eggs.

* Preliminary.

Average Prices of Lucerne and Teff Hay and Certain Meals for Feeding.

Season (1st July–30st June).	Lucerne (100 lb.). Johannesburg (a). Cape	Trans-vaal	Cape Town, Cape 1st Grade.	Teff Johan-nesburg. (a) (100 lb.),	Meals for Feeding: F.o.r. Johannesburg. Lucerne. (100 lb.).	Monkey Nut Cake (200 lb.).	Oats, Sussex Ground (150 lb.).	Bone, 24·8% Protein (100 lb.).	Mixed, 26·4% Protein (100 lb.). (b)
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	3 11	3 1	4 0	2 7	6 9	15 2	15 4	8 5	8 0
1940–41	4 2	3 5	4 3	3 3	6 7	15 3	14 8	11 2	8 7
1941–42	5 7	5 2	5 8	4 7	8 4	—	17 5	10 11	10 10
1942—									
January	4 10	4 7	5 1	4 11	7 6	—	17 6	10 6	10 3
February	4 11	4 8	5 5	4 4	7 6	—	17 8	10 6	10 3
March	5 4	4 11	5 7	5 6	8 6	—	17 6	11 0	10 3
April	5 8	5 6	5 9	6 4	8 6	—	17 6	11 0	10 3
May	7 5	6 11	6 7	6 6	9 6	—	18 0	11 0	15 9
June	8 1	7 7	7 9	7 4	9 6	—	18 0	11 0	15 9
July	7 3	6 4	7 10	6 1	9 6	—	18 0	—	16 6(c)
August	7 4	6 4	7 10	5 5	9 6	—	18 0	—	16 6
September	7 5	6 3	7 5	5 3	9 6	—	18 0	—	16 6
October	6 3	6 7	7 1	5 0	9 6	—	18 0	—	18 9
November	5 1	4 0	6 4	5 5	9 6	—	18 0	—	18 9
December	4 11	4 5	7 1	3 11	9 6	—	18 0	—	18 9
1943—									
January	5 0	4 5	7 3	5 5	9 6	—	18 0	—	18 9
February	5 0	6 6	7 2	5 0	9 6	—	18 0	—	18 9

(a) Municipal Market. (b) Approximately half of the protein is claimed to be animal protein. (c) Per 150 lb

Average Prices of Maize, Kaffir-corn and Dry Beans per 200 lb.

Season and Month.	Maize. F.o.r. Producers' Stations. No. 2. Bags.	No. 2. Ex Elevator.	No. 6. Bags.	No. 6. Ex Elevator.	Cape Town Con-sumers' Price F.o.r. No. 6 in Bags.	Kaffircorn F.o.r. Producers' Stations. Bags, K. 1.	Bags, K. 2.	Dry Beans Johannesburg (Municipal Market). Speckled Sugar.	Cow Peas
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	8 7	8 6	8 6	8 8	13 2	13 1	12 9	25 0	16 9
1940–41	9 2	8 8	9 3	8 9	14 0	15 6	17 0	30 0	16 8
1941–42	—	—	—	—	—	—	—	32 10	19 8
1942—									
January	11 0	10 1	10 10	9 4	14 9	21 5	22 3	34 4	21 9
February	11 0	—	11 0	—	14 8	21 11	22 11	32 7	20 11
March	10 6	—	10 6	—	14 9	20 2	21 1	30 10	19 2
April	10 6	—	10 6	—	14 10	18 5	18 9	32 6	25 5
May	15 0	—	15 0	—	15 6	20 8	20 8	32 8	26 4
June	15 0	—	15 0	—	17 6	21 11	21 11	33 5	26 5
July	15 0	—	15 0	—	17 7	21 8	21 8	33 7	24 8
August	15 0	—	15 0	—	17 8	22 10	22 10	36 7	27 2
September	15 0	—	15 0	—	17 7	24 6	24 6	38 1	28 4
October	15 0	—	15 0	—	17 9	24 8	24 8	39 0	27 6
November	15 0	—	15 0	—	17 10	25 0	25 0	38 6	27 1
December	15 0	—	15 0	—	17 11½	25 0	25 0	37 3	22 7
1943—									
January	15 0	—	15 0	—	18 6	27 3	27 3	33 7	21 4
February	15 0	—	15 0	—	19 2	34 2	34 2	30 1	22 8

Seasonal year for maize and kaffircorn, 1st June–31st May; for dry beans, 1st April–31st March.

Average Prices of Apples, Pears and Grapes on Municipal Markets.

Season (1st July to 30th June).	Apples (Bushel box).						Pears (Bushel box).		Grapes (Tray).
	Johannesburg.			Cape Town.			Johannesburg.		Johannesburg.
	O'heni-muri.	White Winter Pear-main.	Wem-mers-hoek.	O'heni-muri.	White Winter Pear-main.	Wem-mers-hoek.	N.M. No. 1.	Other.	Johan-nesburg.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	7 2	6 0	5 10	7 3	8 0	4 3	6 7	4 2	1 3
1940-41	8 4	7 1	6 4	8 11	10 8	5 7	8 11	6 3	1 8
1941-42	8 11	7 11	7 3	9 1	10 9	6 9	7 3	8 0	1 11
1942—									
January	—	—	—	—	—	—	—	7 5	3 2
February	8 3	—	12 2	8 10	—	—	7 3	7 8	1 6
March	7 5	6 11	7 6	7 7	9 3	6 3	5 6	7 0	1 10
April	8 6	7 6	6 8	7 9	9 8	6 2	—	9 6	1 11
May	8 10	7 7	6 5	8 9	9 7	5 6	—	8 11	2 0
June	10 1	8 10	8 4	9 7	10 9	6 3	—	15 9	2 5
July	11 2	11 4	8 1	10 10	12 1	8 11	—	—	0 10
August	17 6	15 8	10 6	11 7	11 8	9 10	—	—	—
September	16 4	16 3	7 0	11 11	11 3	—	—	—	—
October	16 6	16 3	—	9 11	9 4	—	—	—	—
November	20 8	18 6	—	10 4	7 2	—	—	—	—
Desember	19 7	17 8	—	11 10	17 5	—	—	14 10	3 8
1943—									
January	—	17 5	—	11 5	—	—	—	9 3	2 3
February	10 1	11 0	14 4	8 11	9 0	4 11	—	9 10	1 5

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

Season (1st July to 30th June).	Green Beans (Pocket 20 lb.).			Green Peas (Pocket 20 lb.).			Carrots (Bag). (a)		
	Johan-nesburg.	Cape Town.	Durban.	Johan-nesburg.	Cape Town.	Durban.	Johan-nesburg.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 1
1940-41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	13 4
1941-42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 6
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	19 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 6	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 9	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	6 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10
1943—									
January	1 9	3 3	3 5	2 4	6 9	4 7	3 9	5 1	11 3
February	2 5	4 4	3 5*	4 8	5 9	4 7*	6 0	6 5	11 3*

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

* Preliminary.

Average Prices of Potatoes and Onions on Municipal Markets.

SEASON (1st July to 30th June).	POTATOES (150 lb.).						ONIONS (120 lb.).		
	Johannesburg.				Cape Town.	Durban.	Johannesburg.	Johannesburg.	Cape Town.
	Transvaal No. 1.	Transvaal No. 2.	N.M. Grade 1. No. 2.	N.M. Grade 1. No. 3.	Cape No. 1.	Natal No. 1.	Transvaal.	Cape.	Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940–41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941–42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1941–42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December	11 6	9 6	14 1	13 3	12 2	15 6	9 3	10 11	11 9
1943—									
January	7 9	6 8	10 9	10 8	10 9	14 2	8 5	9 4	7 8
February	8 3	7 2	11 8	11 6	8 4	14 2*	7 10	10 9	7 3

* Preliminary.

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

SEASON. (1st July to 30th June).	EGGS.				HIDES (per lb.).		SKINS.		
	Johannesburg.		Cape Town, per 100.	Durban New Laid, per dozen.	Port Elizabeth.		Port Elizabeth.		
	New Laid, per dozen.	Fresh, per dozen.			1st Grade, Sun-dried.	1st Grade, Dry Salted.	Merino. Medium, per lb.	Merino. Combings, per lb.	Glovers, Sound, per skin.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938–39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940–41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941–42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·5	9·7	3 4
1943—									
January	1 8	1 4	13 11	2 2	8·0	8·1	5·7	9·1	3 4
February	2 3	1 11	16 7	2 2*	8·1	8·1	6·1	10·5	3 5

* Preliminary.

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb.						Pigs per lb. Live Weight.		
	(a) Johannesburg.				(b) Durban.		Johannesburg.		
	N.M. Prime.	Ordinary. Prime.	Good Medium.	Com-pounds.	Medium.	Com-pound.	Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938-39.........	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940-41.........	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941-42.........	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942—									
January.........	63 2	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February.........	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March.........	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April.........	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May.........	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June.........	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July.........	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August.........	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September.....	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
Oktober.......	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November......	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December......	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January.......	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February......	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June to 31st May).	Johannesburg.				Cape Town.			
	Merino Wethers.		Persians and Cross Breds.		Merinos.		Capes and Persians.	
	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938-39..........	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940-41..........	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941-42..........	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942—								
January........	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February.......	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March..........	9·6	8·4	8·8	7·9	9·6	8·8	9·3	8·8
April..........	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May............	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June...........	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July...........	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August.........	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September......	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
Oktober........	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November......	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December.......	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January........	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·4
February.......	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·1

* As sold on the hoof. Reported by Meat Control Board.

Average Prices of Oranges and Pawpaws

Season (1st April to 31st March).	Oranges (Pocket). Johannesburg. N.M. Navels.	Oranges Johannesburg. Other. Navels.	Oranges Johannesburg. Other. Valencias.	Oranges Cape Town. Navels.	Oranges Cape Town. Valencias.	Oranges Durban. Navels.	Oranges Durban. Valencias.	Pawpaws (Standard box). Johannesburg. N.M.	Pawpaws (Standard box). Johannesburg. Other.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 10	1 6	1 5	2 0	2 1	—	—	2 0	1 7
1940-41	1 9	1 7	1 6	1 11	1 10	2 4	2 1	2 2	1 9
1941-42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1941-42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1942—									
January	—	2 6	3 8	2 10	4 7	—	3 11	3 3	2 1
February	—	3 11	4 5	4 7	6 10	3 9	5 8	6 4	3 3
March	—	3 7	2 11	6 6	5 10	4 3	5 6	4 1	3 1
April	2 1	2 0	1 10	3 4	5 0	3 4	2 6	4 0	3 1
May	2 4	2 3	2 1	2 3	2 3	2 6	1 2	3 8	3 1
June	2 3	2 3	1 9	2 1	—	2 6	1 11	2 11	2 5
July	2 5	2 5	1 11	2 1	—	2 8	1 0	2 8	2 2
August	2 11	2 8	2 3	3 0	2 4	3 6	2 4	2 2	1 8
September	2 5	3 3	2 3	3 4	2 2	4 0	2 6	2 1	1 6
October	2 9	2 11	2 7	5 1	3 1	3 7	2 11	2 4	1 9
November	—	3 6	4 0	6 11	3 7	4 6	3 6	3 1	2 6
December	—	3 1	3 8	2 11	4 3	—	4 2	3 5	2 1
1943—									
January	2 0	3 8	4 0	—	4 10	2 4	3 9	3 9	2 0
February	7 1	5 8	5 3	—	7 6	2 4*	3 9*	4 11	3 6

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* Preliminary.

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

Season (1st July to 30th June).	Cabbages (bag). (a) Johannesburg.	Cabbages (bag). (a) Cape Town.	Cabbages (bag). (a) Durban.	Cauliflower (bag). (a) Johannesburg.	Cauliflower (bag). (a) Cape Town.	Cauliflower (bag). (a) Durban.	Tomatoes (Trays 15 lb.). Johannesburg. N.M. No. 1.	Tomatoes Johannesburg. Other.	Tomatoes Cape Town.	Tomatoes Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940-41	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941-42	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1942—										
January	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
February	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
March	4 2	6 10	2 5	—	4 9	5 5	2 6	1 5	2 0	1 4
April	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10
May	3 11	7 10	3 2	—	4 0	—	3 8	1 10	3 0	2 4
June										
July										
August	5 1	9 0	12 6	—	—	—	4 11	2 4	2 6	2 8
September	6 4	10 2	12 6*	5 7	5 8	—	5 5	2 7	1 8	2 8*
October										
November										
December										
1943—										
January										
February										

* Preliminary.

vary, but on the average are approximately as follows: For cabbages: Johannesburg, lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 65 lb., and
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CONTENTS

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[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Information on Departmental Publications.

Farming in South Africa, the monthly journal of the Department, contains popular as well as scientific articles on a variety of agricultural topics, useful to both the farmer and the housewife, while the **Crops and Markets** Section, supplies information on crop prospects, market prices and exports of agricultural produce.

The following particulars in regard to subscriptions and advertisements should be noted:—

Subscription.—Within the Union, South West Africa, Bechuanaland Protectorate, Southern Rhodesia, Swaziland, Basutoland, Mocambique, Angola, Belgian Congo, and British Territories in Africa 5s. (otherwise 7s. 6d.) per annum, post free, payable in advance.

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Send all advertisements direct to the Government Printer, or write to him for details as to tariff for advertisements.

Popular Bulletins.—Bulletins on various agricultural topics are published by the Department to meet public demand. A list of available bulletins giving particulars of cost, etc., is obtainable free of charge from the Editor, Department of Agriculture and Forestry, Pretoria.

Scientific Publications.—From time to time the different Divisions of the Department issue science bulletins incorporating the results of research work conducted by them. Other scientific publications issued are: "The Onderstepoort Journal", "Memoirs of the Botanical Survey of South Africa", "Bothalia", "Entomological Memoirs" and the "Annual Reports of the Low Temperature Research Institute". Information in regard to these publications is obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Press Service.—The Press of South Africa is now supplied with a bulletin of agricultural information for their exclusive use. This information is published fortnightly by all newspapers and other journals throughout the country.

Farmer's Radio Service.—In addition to the printed information supplied by the Department to members of the farming community, the Department, in collaboration with the South African Broadcasting Corporation, also maintains a daily broadcasting service to farmers. Information in regard to times of broadcasting is contained in the programmes issued by the Broadcasting Corporation.

Inquiries.—All general inquiries in regard to the publications of the Department, including the Radio Service, should be addressed to the Editor, Department of Agriculture and Forestry, Pretoria.

D. J. SEYMORE, Editor

FARMING IN SOUTH ... AFRICA

Vol. 18 MAY 1943 No. 206

Editorial:

Trends in the Live-stock Industry.

In the agricultural industry, and especially the livestock industry, the observable influence of the past on the present day, and that of present times on the future, is of a long term nature. The damage to the livestock industry arising from droughts and other detrimental factors cannot easily be repaired, nor the effects of the latter rendered less harmful, because the natural increase of the livestock population restricts any attempts at improving the position. This fact is of great significance just now, because man's great ingenuity in utilizing man-power and financial resources, to transform and put into operation, an entire industry almost overnight, tempts us to the belief that he will be capable of saving even the livestock industry by diverting it from its present course into channels which will lead to an assured and successful future.

In our national economy the livestock industry plays an important rôle and represents a huge investment of capital, which after many years of careful management could warrant the expectation of a bright future. There are, however, influences at work which, if they are not checked, may have very adverse effects. Those interested in the industry should, therefore, closely watch present-day trends.

Even before the outbreak of war a speculative spirit had manifested itself in this industry. At first it spread slowly, but subsequently gained ground with ever-increasing speed. Producers and capitalists bought oxen and steers and kept them for speculative purposes on farms which normally would have been used for breeding stock. The result of this process is, that slaughter-stock change hands several times before reaching the abattoirs. In the meanwhile these animals bought for purely speculative purposes consume grazing required by breeding stock. In the light of the fact that the percentage increase and turnover of our livestock is already much lower than in other countries, this speculation must be condemned as a practice which will inevitably result in a serious national loss. Low prices and expectation of boom due to a heavy war-time demand for meat were the main factors which gave rise to this widespread speculation.

Producers also made use of this opportunity to increase their farm income by speculating on a market which was continually rising. When the present high price level was reached, the necessity for this speculation disappeared and the attendant risks were undoubtedly increased. Since all indications point to the possibility of a fairly long period of stabilized high prices in the cattle market, producers should take advantage of this opportunity to build up their herds of breeding stock. The breeding aspect of this industry now requires the farmer's undivided attention.

It should be clear to all concerned that in view of the increased risk attached to speculation, any cattle-farming undertaking, concentrated on the breeding aspect of the industry, must be by far the sounder proposition.

The time is opportune for raising and maintaining breeding stock, since inferior animals can now be disposed of at remunerative prices in order to provide more pasturage and feed for the former. The opportunity for strict classing of herds which are being built up in accordance with the demand of the breed, offers a future, safer and more secure than that of an enterprise based on speculation.

A second trend against which the industry must be warned concerns our dairy cattle. The great demand for milk and the acute shortage of this commodity has been responsible for a very strong tendency among dairy-farmers to slaughter all calves. Producers must realize, however, that there is no justification for the slaughter of heifers which are the progeny of good cows. This practice and its results must uncompromisingly be entered on the debit side of our national economy. Its detrimental effects will make themselves felt to their full extent only after a few years, when animals which are now in production, will have to be replaced on account of old age or mortality

The present scarcity of the necessary constituents for the rations of dairy cows, has made the presence of poor producers in the herd even more inexcusable than in the past. Such animals must be disposed of without delay. In order to cope with the feed problem, farmers should make every effort to produce the maximum amount of greenfeed. Wheat and oats can be sown for pasturage, and, where plants are obtainable, Chou Moellier and rape may be planted to provide supplementary feed. Wherever possible producers should cut this maize close to the ground so that the stalk together with the ears can be stacked in stooks for drying and ripening. The extra labour involved will be amply repaid by the excellent fodder which is obtained in this way and which can be used when the need is greatest.

(W. F. Bergh, Senior Professional officer, Division of Animal and Crop Production, Pretoria.)

Nursery Quarantines.

The following nursery quarantines were in force on 1 April 1943:—

(1) Page's Nurseries, Franschhoek, C.P., on citrus (all) for red scale.

(2) Stuber, C., Mowbray, C.P., on palms (part) for circular purple and silvaticus scales; on strelitzias for circular purple scale; and on araucarias for araucaria scale.

(3) Beaulieu Nurseries, Forestdale Siding, P.B. Grahamstown, C.P., on citrus (all) for red scale.

A NEW BULLETIN FOR THE SHEEP FARMER.

Bulletin No. 236 "Cactus and Oldman-saltbush as Feed for Sheep" has recently been published. The Bulletin is obtainable from the Editor of Publications, Pretoria, at 6d. per copy.

Camel-thorn Pods as Stockfeed.

Dr. Douw G. Steyn, Veterinary Research Officer, Onderstepoort.

DURING periods of drought and now that stock feeds are very scarce, questions as to the nutritive value of the camel-thorn tree (*Acacia giraffae* Willd.) reach us from different areas. Some stock owners actually had reason to suspect that the pods of the camel-thorn tree caused poisoning of their stock.

As a result a few species of *Acacia* (thorn trees) were subjected to experiments and the results are given below. The investigation is being continued with other species of *Acacia*.

Fig. 1.—*Acacia giraffae* Willd. with fruit. (Half natural size.)

The Transvaal Camel-thorn Tree.

It is a well-known fact that the mature pods of the Transvaal camel-thorn tree, *Acacia giraffae* Willd. (Fig. 1) are of high nutritive value. A sample of ground mature pods, which was sent to us from the Orange Free State, was found to contain dangerous quantities of prussic acid. Two camel-thorn trees growing in the vicinity of Wonderboom, Pretoria, were then examined, and it was

Fig. 2.—*Acacia Karoo* Hayne, with flowers and fruit. (Half natural size.)

found that the fresh green foliage, green pods and the mature pods contain dangerous quantities of prussic acid (cyanogenetic-glucosides). According to the samples examined the foliage contains the greatest amount of prussic acid and the mature pods the least.

The Mimosa.

Samples for examination were taken from mimosa trees. *Acacia Karoo* Hayne (Fig. 2), growing at Onderstepoort. The fresh foliage, flowers and green pods were repeatedly tested, but no prussic acid (or cyanogenetic-glucosides) was found.

The Natal Camel-thorn Tree.

The Natal camel-thorn tree, *Acacia lasiopetala* Oliv. (Fig. 3), is regarded by stock farmers as an excellent feed for animals. Yet it was found that green twigs, beaten off by a hailstorm which passed

over a camp on a farm in the Kliprivier District, Natal, caused the death of sheep which fed on them. The fresh and dry foliage, and the flowers of the samples which were sent to Onderstepoort, were found to contain large quantities of prussic acid (cyanogenetic-glucosides). In experiments at Onderstepoort it was shown that one pound of the fresh foliage contained sufficient poison to kill a sheep within half an hour. In contrast to the Transvaal camel-

Fig. 3.—*Acacia lasiopetala* Oliv. Yellow flowers. (Half natural size.)

thorn tree the immature thorns on the tips of the young sprouts of the Natal camel-thorn tree are so soft that stock can easily ingest 4 to 8 inches of the ends at such a rate as to become fatally poisoned.

Haak-en-Steek.

Samples of *Acacia litakunensis* Burch. (Fig. 4), obtained from Brits, Transvaal, were also examined, and the seeds of the ripe pods showed very minute quantities of prussic acid, but these quantities of prussic acid are so small that there is no danger of poisoning. However, it is possible that the pods may at times contain more prussic acid. The foliage has not yet been examined.

English Thorn.

Samples of *Acacia robusta* Burch. (Fig. 5), were sent in from the Pietersburg district. The foliage and green pods contain very

small quantities of cyanogenetic-glucoside. According to the samples examined there is very little or no danger that animals which feed on the foliage and pods of this tree will be poisoned. It must, however, be taken into account that there is the possibility that the amounts of prussic acid may vary in different trees and on different days.

The Trassiebos.

Samples for examination were taken from an *Acacia stolonifera* Burch., growing near Wonderboom, Pretoria. The fresh and the dried foliage and green pods of this plant contain large quantities of prussic acid (cyanogenetic-glucosides).

Are Acacia Species containing Prussic Acid Suitable as Stock-feed?

It is a well-known fact that the mature pods of both the Transvaal and the Natal camel-thorn tree have been fed extensively and with good results to animals, especially during periods of drought. But several stock owners who fed the pods of the Transvaal Camel-thorn tree (Fig. 1) to their stock, complained that these pods caused poisoning. Since we know that the pods contain cyanogenetic-glucosides, it is quite conceivable if the pods are not judiciously fed.

Nutritive Value of Acacia Pods.

According to analyses made at Onderstepoort, ripe pods of Acacia trees contain:— 12 per cent. protein, 0·26 to 0·34 per cent. phosphorus, and approximately 1 per cent. calcium.

The high protein content therefore makes these pods an excellent feed, but it is desirable that an equal quantity of mealie meal should be mixed with them in order to obtain a well-balanced ration.

There is very little danger that animals will be poisoned when they pick up the mature pods in the veld, primarily because an animal will seldom consume large quantities of these hard pods, and secondly because the pods, being very hard, are consumed at a slow rate. However, cases of poisoning with these pods have occurred under field conditions in animals that were starved. The danger of poisoning is greater when the pods are first ground and then fed, as is sometimes done in dairies.

It is a general rule that the amount of prussic acid in plants varies largely at different times.

The toxicity of any plant containing prussic acid, largely depends upon the rate at which it is consumed, because prussic acid is a gas and is very rapidly eliminated by the lungs. A quantity of a plant (containing prussic acid) which may have fatal results when eaten within an hour's time, would be harmless if consumed over a period of five hours, or in small quantities at long intervals. If dry plants containing cyanogenetic-glucosides and the necessary enzymes, are moistened, prussic acid is rapidly liberated. Such moistened plants are, therefore, much more dangerous than the dry plants, especially if they are left for some time after being moistened.

Feeding Mature Acacia Pods.

The mature Acacia pods can be fed to animals in the following way without any harmful results:—

(*a*) *Feed small quantities at a time.* Cattle, for example, can be given 6 lb. each or more per day, provided this quantity is divided into three portions and fed at intervals of approximately four hours. It is rather difficult to prescribe definite quantities of pods which can

be fed, since the prussic-acid content varies to a large extent. *It is therefore advisable to feed certain quantities of pods over definite periods to a few inferior animals, before feeding to many or to valuable animals.* As already stated, the green pods contain more prussic acid than the mature ones.

(*b*) *Ground pods should not be moistened a long time before being fed.* In some dairies large quantities of ground pods are fed to dairy cows. Some owners moisten the camel-thorn pod meal,

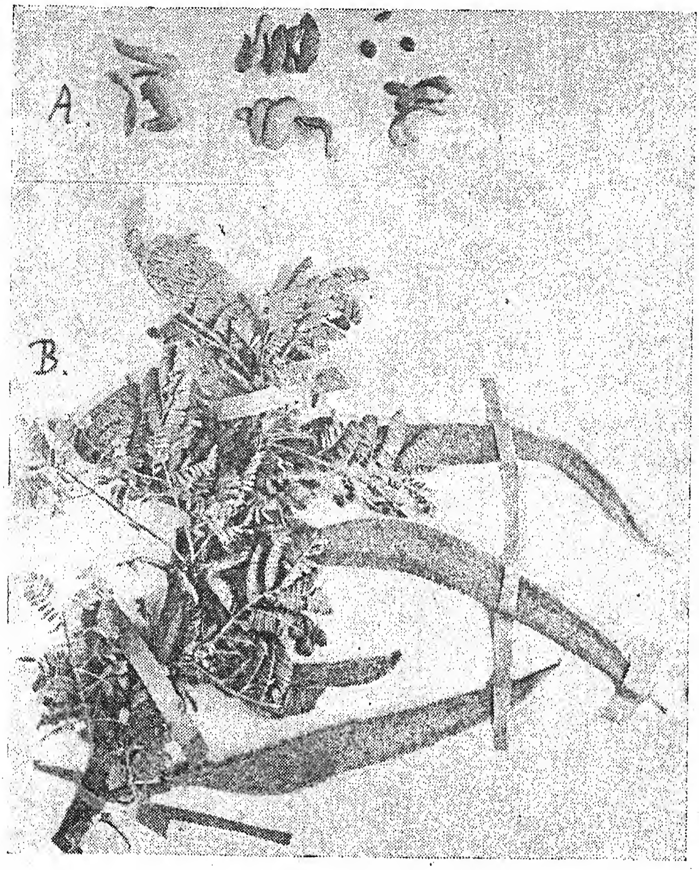

Fig. 4.—A. *Acacia litakunensis* Burch. B. *Acacia solonifera* Burch. (Half natural size.)

leaving it for a while before feeding it to the cows. For the reasons given above, such moistened pod-meal is much more dangerous than the dry pods. *The safest way is to mix the ground pods (pod meal) with bran or an equal quantity of mealiemeal, and to moisten the mixture slightly just before being fed.*

(*c*) *Poisoning through substances containing prussic acid can be largely avoided by mixing it with sulphur or molasses.* Sulphur gives more protection than molasses against prussic acid. The quantity of sulphur to be mixed with ground pods should be such that cattle do not get more than one ounce (two tablespoons) of sulphur each per day. That is, if cattle eat about ten pounds of pod

small quantities of cyanogenetic-glucoside. According to the samples examined there is very little or no danger that animals which feed on the foliage and pods of this tree will be poisoned. It must, however, be taken into account that there is the possibility that the amounts of prussic acid may vary in different trees and on different days.

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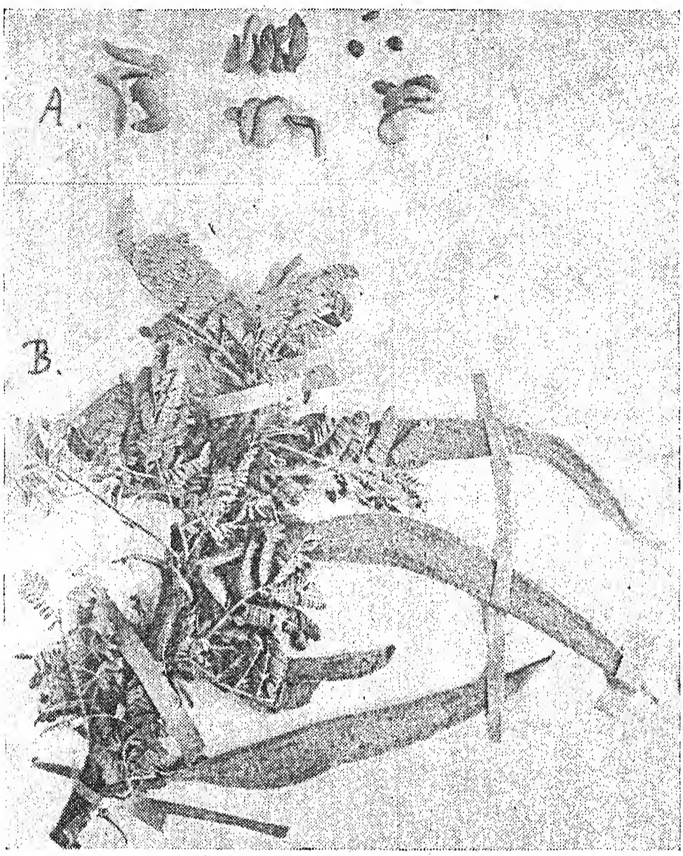

Fig. 4.—A. *Acacia litakunensis* Burch. B. *Acacia solonifera* Burch. (Half natural size.)

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meal each a day, then one pound of sulphur should be thorou
mixed with one hundred and sixty pounds (160 lb.) of pod m
Sheep should not eat more than ⅛ of an ounce (one teaspoon)
sulphur each per day.

A Sulphur Lick.

The most practical method of administrating sulphur to anim
as a preventive measure against prussic-acid poisoning ("Ge
siekte"), is to mix it with the licks. In this case we assume that t
animals have daily access to the licks and that they regularly take

Fig. 5.—*Acacia robusta* Burch. (Half natural size.)

sufficient quantities, as long as danger of prussic acid poisoning exists. Instead of mixing the sulphur with the pod meal, therefore, the animals may be allowed access to a lick containing about one pound of sulphur to every ten pounds of lick. In this way also prussic acid poisoning (or geilsiekte*) in animals which may eat too large a quantity of the pods on the veld, may be prevented.

If molasses is used, the pod meal need merely be moistened with it. There is no reason why sulphur and molasses should not be used simultaneously.

In winter, when the leaves of the Acacia trees have dropped and are dry, they contain less prussic acid than when they are fresh and green. If these trees were not so completely covered with thorns, many animals greedily eating the green leaves containing prussic acid, would have been poisoned. It is well known that giraffes feed on the leaves of the Transvaal camel-thorn tree, but the thorns prevent them from feeding at such a rate that they are poisoned. We have seen what may happen when twigs, which are devoid of thorns (as described in the case of the Natal camel-thorn) are eaten.

* See also article on "Geilsiekte" in *Farming in S.A.* of January, 1940 (or Reprint No. 2/1940, obtainable from the author).

Sweating Sickness in Calves.

Dr. J. I. Quin, Veterinary Research Officer, Onderstepoort.

SWEATING sickness is a disease of young calves, usually under 6 to 9 months old, and seldom occurring amongst older animals. It appears during the hot summer months (December-March) and is usually limited to the bushveld areas of the Union, e.g., northern and eastern Transvaal, Zululand, Northern Natal, as well as Swaziland and parts of Bechuanaland. The disease is also well known in Rhodesia and in certain areas of Central Africa. Individual cases of sweating sickness may also be encountered on the highveld areas of the Union.

There is no certainty whatever concerning the cause of sweating sickness. Although at times it appears as if it might be of an infectious nature, the experiments thus far conducted do not support this viewpoint. Thus numerous attempts made to transmit it from calf to calf by means of blood and other organ material have all consistently failed so far. Nevertheless the seasonal occurrence of sweating sickness coincides with such diseases as horse-sicknes and blue-tongue, and hence the possibility of it being a transmissible disease has to be borne in mind, although no disease-producing agents could as yet be detected in the blood or other parts. Another contributory factor which has to be considered is the possible influence of climatic conditions, especially of sunlight, on young calves in the warmer areas.

Symptoms.

The disease is associated with a high fever which may last for several days. From the beginning there are definite signs of drowsiness and fatigue, accompanied by a loss of appetite. Frequently the sick calf completely refuses to suck from its mother. At this stage the mucous membrane of the mouth, tongue and gums may be red and swollen, hence the increased pain caused should the animal try to suck from the udder.

Soon after the onset of these symptoms a typical moistness, from which the disease derives its name, makes its appearance on certain parts of the skin, usually along the neck, behind the shoulders, on the flanks and between the hind legs. When touched, these areas feel warm, moist and even somewhat sticky. This is associated with a loss of hair and a bad odour from the affected skin which becomes inflamed. Subsequently it is covered with scabs which, if removed, may leave a bleeding surface.

This skin moistness should not be regarded as normal sweating as this very seldom occurs in cattle. It is more in the nature of a *wet eczema* caused by the appearance of blood serum of the skin. A flow of saliva from the mouth as well as tears from the eyes may be additional symptoms frequently noticeable. Sick animals lose condition very rapidly and death may follow within a few days. On the other hand recovery may be slow and accompanied by the loss of considerable patches of skin and hair.

The number of actual deaths in calves may vary widely, according to the seasonal severity of the disease and especially with the treatment applied to sick animals. Hence the majority of affected calves may be lost during a severe outbreak unless adequate treatment is resorted to at once. Where the disease is taken in hand as soon as it appears, losses can, however, be reduced to a very small percentage, i.e., to a few individual animals only.

Treatment.

Due to the fact that the cause of sweating sickness is as yet unknown, no adequate preventive measures can be prescribed. Moreover, there is no satisfactory evidence that the disease can be warded off by regular dipping or by other commonly applied hygienic measures. Under these conditions the treatment of sick animals as they occur is the only method available whereby calf losses can be minimized as far as possible. This object can be achieved by carefully complying with the following suggestions:

(1) Wherever sweating sickness is known to occur, all young calves are to be inspected daily during the warm summer months. This concerns calves running freely with their mothers as well as those penned off, since sweating sickness may appear amongst both groups.

(2) With the onset of the first signs of illness, the cause of which is not at once apparent, all sick animals are to be kept in the shade as provided, e.g., by trees or some other form of shelter until they are recovered. On the other hand, should the weather turn cold and rainy, they are to be kept warm and dry under the shelter.

(3) As the sick calf probably refuses to suck from the udder, steps should be taken to ensure that enough fluid in the form of milk and water is dosed either by bottle or fed from a bucket regularly three times a day. Unless this is done, the body tissues are rapidly dried out, with the result that death may follow within a few days.

(4) To maintain body strength, it is further advised that ½ lb. freshly minced *raw liver*, shaken up in water, should be dosed daily for several days. This treatment frequently leads to rapid improvement in the general condition. In case fresh liver is unobtainable, 2 to 3 tablespoons of dried yeast (e.g., brewers' yeast), or two cakes of compressed yeast should be dosed daily after being mixed in a little water.

(5) To limit the fever reaction during the first stages of the disease, 1 to 2 aspirin tablets should be dosed twice daily.

(6) The skin lesions, which in some cases may be very extensive, should be treated with some soothing oily preparation, e.g., carron oil, which can be made by shaking up equal quantities of raw linseed oil and lime water. To this emulsion small amounts of either tannic acid or bark extract could be added. In addition strict precautions should be taken to avoid blowfly infection of the affected skin.

(7) With recovery of the animal, increased amounts of milk and gruel should be provided, as well as some form of green feed in the case of older calves. Under no circumstances should strong irritant substances be dosed to calves, nor should they be applied to the skin.

Further Research Work.

In order to obtain the necessary information about the cause and nature of sweating sickness, it is essential to follow up certain definite leads or indications. These can, however, be supplied only by farmers themselves or by field officers closely associated with cattle farming in sweating-sickness areas. For these reasons an appeal is made to all those who might be in a position of collecting the following information:—

(*a*) Careful recording of all the areas in which the disease occurs; (*b*) percentage of calves affected and the actual number of deaths; (*c*) age, breed and condition of the calves affected by sweating sickness; (*d*) general climate and more specifically the actual

 [*Continued on page* 332.

Breaking the "Rest Period" of Deciduous Trees.

Dr. H. T. Kriel, Horticulturist, Subtropical Horticultural Research Station, Nelspruit.

THE term "rest period" is used to indicate that phase in the growth cycle of deciduous trees when the parts above ground will not grow, even under favourable conditions of temperature and moisture. Before such a resting plant can resume active growth, some internal change has to be affected, and in nature this is normally brought about by cold.

FIG. 1.—Showing the injected branch. Injected 7th May 1942 and photographed 25th June 1942.

FIG. 2.—Showing the Control Branch on same tree. Photographed 25th June 1942.

For a long time, however, horticulturists and physiologists have been interested in breaking the rest by artificial means, and a certain amount of success has been achieved. It has been found, for instance, that the rest period could be affected by subjecting the plants to treatments, such as: immersion in warm water, or weak solutions of sodium nitrate, potassium chloride, copper sulphate, hydrochloric acid, oxalic acid, hydrogen peroxide, and other substances; fumigation with ether, chloroform, ethylene chlorhydrin, etc; spraying with certain oils; injections with extracts of yeast, or other organic substances, or with pure chemicals. The degree to which the rest period is broken by these treatments depends on the kind of plant and also on whether the rest is deep or light.

Some work done on this station indicates that a fairly deep rest of peaches, plums, and some other trees growing in this area can be broken by injecting the branches with a 2½ per cent. solution of sodium thiosulphate in acid medium. Flower and leaf buds were found to emerge 4 to 6 weeks after treatment, while all the buds on untreated branches remained dormant. The fruit on the treated branches ripened far in advance of the fruit on untreated branches.

The effect of the injection on blossom and leaf-bud development is shown in the photographs.

The subsequent effect on fruit development is shown in fig. 3.

The work done is of a preliminary nature, but may be of interest to workers in other areas. Further tests are being carried out and a detailed report will be published when more information becomes available.

The author does not consider it advisable at this early stage to supply any further information with regard to the possibility of its practical application.

Fig. 3.—Showing size of fruit on injected branch (left), compared with size of fruit on control branch (right). Injected 7th May, 1942, and photographed 26th October, 1942.

New Bulletins.

Reinforced Circular Reservoirs. Bulletin No. 234 3d.
Eggs and Poultry in Cookery. Bulletin No. 237. 6d.
Bush Tea. Reprint No. 8.
Linseed and its Cultivation. Reprint No. 16.
Pyrethrums. Reprint No. 41/1940.
The Planting of Potatoes. Reprint No. 14.
Crop-production Policy in the Present Emergency. Reprint No. 37.
Nicotine for Aphids Reprint No. 30.
Legumes in Crop Rotation. Reprint No. 38.
Specifications for the Construction of Circular Dams.
Potato Production. Reprint No. 40.
The Production of Vegetable Seed. Reprint No. 7.
Garden Carrots. Reprint No. 10.
Conversion of Refuse into Soil Fertility. Reprint No. 43.
Control of Worms in Sheep. Reprint No. 29.
Schemes for Soil-erosion Control and Water Conservation. Reprint No 61/1936.
Poisonous Plants. Reprint No. 70/1941.
Poisonous Stock Feeds. Reprint No. 51/1941.
Artificial Incubation of Eggs. Reprint No. 32.
Rearing and Feeding of Chicks. Reprint No. 18.
Compost. Reprint No. 34.

(Obtainable from the Editor of Publications, Pretoria.)

New Method for Estimating the Fertilizer Requirements of Citrus Trees.

A. C. Bathurst, Division of Horticulture, Pretoria.

THE usual methods of finding out the fertilizer requirements of crops, such as citrus, are: (*a*) field experiments, and (*b*) soil analyses.

A promising new method, namely *plant analysis*, has received a good deal of attention from the author during the past few years—the object being to find a cheaper and quicker method than that of the field experiment, and a more accurate and reliable method than that of soil analysis. Results from this new method are now thought to have reached a stage where a fair amount of reliance can be placed on them, and where citrus growers may be interested to learn something about the methods employed.

Field Experiments: Accurate, but Slow and Costly.

It must be admitted that the field experiment is, and will always be, the criterion by which all other methods must be judged. In other words, the only *certain* way we have of finding the effect of any treatment on any orchard is to apply that treatment and to record the effect of the treatment on the tree and crop. Unfortunately there are several serious drawbacks to such methods. Firstly, an ideal experimental orchard is very hard to find. It must be large enough to include a number of different treatments and a large number of replicates of all of these and, further, a sufficient number of trees, known as "guard-trees", to separate the different plots from one another. The soil in this orchard must be reasonably uniform and generally respresentative of soils in that area, and should not have been fertilized heavily in the past, or the "carry-over" effects of these fertilizers may mask any differences due to experimental treatments. Furthermore, the owner must be willing to co-operate, and the experiment must run for at least four or five years, preferably a good deal longer. Granted these conditions, we may, after several years, and at a considerable cost, obtain information concerning the effect of certain fertilizer treatments on trees of a certain age, growing in a particular soil over a certain period. While this information should be of great value to the particular grower concerned, there is no proof that exactly the same results would follow similar treatments in a nearby orchard. Practical experience shows us that while this may often be the case, yet in many other instances it definitely is not so. In other words, each orchard should really be experimented on separately. A further very serious drawback is that while certain fertilizer treatments may increase yields remarkably for the first few years, their cumulative effects, due to the washing out of soil minerals, or by a damaging effect on soil structure, or by gradually changing the chemical composition of the tree, may eventually be very harmful—possibly so much so that the damage may be economically irreparable. If, therefore, the experiment be abandoned before these cumulative effects set in, entirely misleading and dangerous conclusions may be drawn. The conclusion is that, to be of real value, field experiments must be carried on over a good many years, and repeated in a large number of orchards.

Soil Analysis: Cheap but Vague.

Most people still seem to be under the impression that a clever enough chemist can predict just how a certain piece of soil should be

fertilized from a simple laboratory anaylsis of that soil. Given sufficient practical experience with the type of soil and the particular crop concerned, it is true that he can often give good advice of a general nature, and the cost of obtaining the information may not be large. The limitations of the method, however, should be clearly realized, e.g., the amounts of plantfood extracted from any soil by chemical means in the laboratory, are not necessarily the same as the amounts which would be taken from that soil by a plant.

The value of a soil to a plant does not depend upon the *total* amount of plantfoods present in it, but upon the *rate at which the plant can extract* these plantfoods. Various chemical methods have been proposed and used in an attempt to determine this rate of availability. The fact remains, however, that all these methods are arbitrary, and it is necessary to check up conclusions based on them by means of extensive field trials repeated over a wide range of soils and climates, and for each and every crop concerned.

It is well-known that different crops have quite different food requirements and differ in their capacities to extract plant-foods from the soil. While our knowledge on these matters is constantly increasing, it is not yet by any means adequate. We are now finding out, for example, that some plants can actually obtain their potash from undecomposed soil minerals, such as mica, formerly considered inert, and of no value to plant life. The presence of such potash is not usually disclosed by ordinary soil-analysis methods, which can take no account of the power of any particular plant to absorb that potash.

A further complication in drawing conclusions from soil analyses is that the functions of many of the different plantfoods are so interrelated that either a deficiency or an excess of one plantfood may seriously interfere with the absorption or utilization of another. It is well known, for instance, that large amounts of lime in the soil may cause a plant to suffer from a deficiency of iron. Since there are at least a dozen or more different chemical elements, each of which is essential for normal growth, and which must be absorbed by a plant from the soil in sufficient, and yet not excessive amounts, the complexity of the problem can easily be realized. The tremendous variations in the chemical content of different soils, even a few yards apart, one often containing a hundred times as much of a certain plantfood as another, make it extremely difficult to say which soils contain sufficient, and which insufficient supplies of the various plantfoods. Another obvious drawback is the difficulty of sampling just that portion of the soil occupied by the roots. Plantfoods out of that range are not normally available to the plant at all.

The above unavoidable weakness inherent in soil analyses, and the expense and length of time necessary for carrying out field experiments, have convinced the writer that there is a great need for some other cheap and yet reliable method for estimating fertilizer requirements of crops, such as citrus.

Plant Analysis: A New and Promising Method.

The idea of analysing a plant to determine its fertilizer requirements is not, strictly speaking, a new one, since it was first suggested some sixty years ago. For various reasons, however, chiefly due to unreliable sampling methods, poor analytical methods, faulty methods of drawing conclusions, and lack of knowledge of basic principles governing plant growth, the method did not become popular. It may be of interest, however, to quote briefly from a recent paper by two of America's leading plant physiologists, who recently received the annual thousand-dollar award granted by the

American Association for the Advancement of Science for a very notable contribution to science for the year 1940. The authors, Drs. Hoagland and Arnon, state: "The idea of analysing plant tissues in the study of nutrient deficiencies is a venerable one, but we gain the impression that there is a renewal of interest in this approach . . . . In experiments with barley and tomato plants there was a high correlation between percentages of potassium in the dried vegetative tissues, and the response of the plant to potassium fertilization. The possibility also exists of sometimes obtaining useful indications of potassium-supplying power of soils from analysis of samples of plant tissue taken at suitable stages of growth from plants growing in the field."

It is precisely this aspect, namely the relationship that has been found to exist between the amount of a certain plantfood found in a plant, and the response it will show to applications of that plant food that is the basis on which the "Plant Analysis Method" is founded. While in soil analysis we extract the plantfoods with water, acids, or other chemicals, we can never be sure that what we get out of a soil is the same as what the plant would get out of it. By analysing the plant, however, we are taking a short-cut as compared with soil analysis, since we use the plant itself as the means of removing the plantfoods from the soil. Theoretically speaking, this method of approach should take us a big step nearer the heart of the problem. By making a large number of analyses, both of healthy plants and also of plants known to be suffering from definite shortages or excessive amounts of various plantfoods, we can eventually find out with very fair accuracy, how much of each of the essential plantfoods a healthy plant of any particular species should contain. This has actually been done in the case of various field crops over widely varying conditions in the U.S.A., Great Britain and Sweden, with encouraging results. To sum up the findings from these countries, we may state that regardless of the climatic and soil conditions, the chemical composition of the healthy plants of a certain species varied only within a very small range, and also, all plants containing less than normal quantities of any particular plantfood usually responded to fertilizers containing that plantfood. The evidence available suggests very strongly that it should be quite possible, by means of plant analysis, to predict the main fertilizer requirements of any plant, no matter what the soil and climatic conditions may be. This is something which soil analysis cannot do—for neither the individual requirements of the plant, nor the plantfoods which it can actually take up, nor the prevailing climatic conditions are taken into account.

Predicting the Fertilizer Requirements of Citrus.

During the past four or five years, the writer has laid down several large fertilizer experiments on citrus in various parts of the Union. The objects were twofold: firstly, to find out by trial and error the best fertilizers for Valencias under each of the different soil and climatic conditions, and secondly, to discover just how the amounts of the various important plantfoods in the trees were affected by the various soils and the fertilizers given. These experiments have now provided some valuable information which may be summarised as follows:—

In an orchard in the eastern Transvaal striking improvements in yield—two or three times the yield of unfertilized plots—followed annual applications of nitrogen in the form of sulphate of ammonia, at the rate of 3 to 7 lb. per tree. This orchard has previously received practically nothing in the way of fertilizers or manures. In another

orchard in the western Transvaal, receiving exactly the same treatments, slight but definite *decreases* in yield resulted from the same applications of ammonium sulphate—the heaviest applications causing the greatest falling-off in yields. This orchard had previously received about 150 lb. kraal manure per tree annually for several years, though no artificial fertilizers.

Still a third orchard on the rich alluvial soils of the eastern Cape Province which received no fertilizers or manure in the past, showed no response to the identical fertilizer treatments one way or the other.

Analysis of Citrus Leaves.

The above results may seem rather confusing at first sight, yet when analyses of leaves from these orchards were made, the whole position became clear.

In the case of the first orchard, which showed the greatest response, the amount of nitrogen in the leaves was originally very low. Where ammonium sulphate was given, the nitrogen content of the leaves was raised and at the same time increases in yield invariably followed. In no case was the nitrogen content of the leaves raised to what could be called an abnormally high figure, and in all cases the more nitrogen given as ammonium sulphate, the more the yields were raised.

In the case of the second orchard (in the western Transvaal) the leaves were already very high in nitrogen when the experiment was started, due to the effect of the nitrogen previously given in the kraal manure. Here the applications of ammonium sulphate raised this content even higher still, and the more of this fertilizer given, the more yields *decreased*. From this it was judged that nitrogen was not lacking in this orchard, and that by giving more than was actually required, the tree was, so to speak, nitrogen poisoned, and yields fell off in consequence.

In the third orchard (in the eastern Cape Province) the leaves were about normal in nitrogen content at the start, and even after several years of fertilizing only slight increases could be brought about by giving ammonium sulphate. In this orchard no provable differences in yield were found between any of the different treatments. This again fits into the picture, and suggests that the way in which a tree is likely to respond to nitrogen fertilizers can be predicted if we know whether its leaves are low, normal, or high in nitrogen to start off with. If the content is low, the crop will probably be increased; if normal—probably not, though harmful effects will not necessarily follow; if already high, no good can be done, nitrogen fertilizers will be wasted, and an actual falling-off in yields is quite possible.

The amounts of the other most important plantfoods, namely phosphorus, calcium, potassium, magnesium and sulphur present in Valencia leaves have been investigated in a similar manner, and both the normal content of leaves and the levels at which deficiencies are likely to occur for each of these has been determined.

A Practical Example.

An interesting case of the practical application of leaf-analysis may be mentioned here in connection with the eastern Transvaal orchard already referred to. Here, soil analyses showed that the soil was very acid, and low in both calcium (or lime) and magnesium. The normal recommendation here would be to give lime, or perhaps dolomite, which contains both lime and magnesium. An analysis of

the citrus leaves, however, showed that they were very *high* in lime, and very *low* in magnesium. Applications of magnesite (which contains magnesium, but no lime) were therefore given to two out of the four trees in each experimental plot. After two years it now appears that this treatment is having beneficial results, since in eleven out of sixteen cases the magnesite-treated trees are now outyielding the trees which did not receive it. Had lime alone been given, the uptake of calcium, already high, would have been raised still higher, and the shortage of magnesium would probably have been aggravated, with probable harm to the tree.

Method of Taking Samples.

Many hundreds of analyses of leaves made by the writer during different times of the year, and of samples taken in various ways, have shown quite clearly that the amounts of each of the different plantfoods vary greatly from leaf to leaf in any particular tree, chiefly according to the age of the leaf on the tree. This makes it quite clear that for leaf analyses to be of any value, a definite method of taking samples must be followed, and leaves must only be picked from a certain stage of growth, and at a certain time of the year. This sampling method is simple, and may be summarised as follows:—

Leaves are taken from the stalk of the fruit, directly up against the fruit, during the period June to July. Since the date of the Spring flush, when the fruits and leaves were first formed, can easily be found out, the exact age of these leaves can also be found—namely, ten to eleven months old. All samples, picked in any part of the country, will be of approximately the same age, and are thus comparable. No great skill is needed in selecting a good sample of leaves, which can easily be picked by any interested grower.

An Invitation to Growers.

The work outlined above has now reached a stage where it seems desirable to test out conclusions more extensively. To this end, the Division of Horticulture wishes to get into touch with interested growers in all parts of the country with a view to diagnosing the fertilizer needs of their orchards by leaf-analysis methods, and following up the responses caused by the fertilizers applied.

The fertilizer position in the Union at the moment is such that every effort must be made by all growers to apply only those fertilizers actually essential for maintaining or raising production.

In very many cases fertilizer mixtures are quite unnecessary for citrus trees, and growers could economize by changing over to a single fertilizer alone. In other cases it is quite possible that the amounts of fertilizer given are excessive, and could be cut down quite safely without causing a drop in yields. Growers would not only help themselves by such economies, but would leave more fertilizers to those farmers who might otherwise be forced to do without them.

Any growers interested in this subject, and wishing the Department to report on the probable fertilizer requirements of their orchards as indicated from leaf-analyses, are cordially invited to communicate with the Chief, Division of Horticulture, P.O. Box 994, Pretoria. No charge will be made for this service, and the grower will be under no obligation to carry out suggestions which may be made.

List of Bulletins and Reprints.

Division of Chemical Services, Pretoria.

No.		Price
*3	Notes on the chemical control of cattledipping tanks	
*4	Composition of some indigenous grasses	
*5	Investigation of different methods of testing Babcock milk bottles	
*8	Comparative determinations of the lime requirements of soils by different methods	
*10	Animal oils, fats and waxes	
*14	Some analytical methods	
*21	Quantitative determination of nitrates in soil	
*22	White versus yellow maize as a pig and poultry food	
*24	Nitrification in some South African Soils	
*25	Revision of acid phosphates in acid soils	
*26	Disaggregation of some rock and soil-forming minerals	
*27	Twenty years of chemical progress in South Africa	
*28	Representative Transvaal Soils: Springbok Flats Black Turf	
*29	Representative Transvaal soils: Sandy soils and sandy loams on the older granite	
*30	Preliminary chemical investigations of three South African plants	
*31	Investigation into some physical and chemical changes occurring in grapes during ripening	3d
*32	Legumes versus nitrate of lime as affecting the yield of barley	
*33	Composition of ripe wine grapes	3d
*35	Representative Transvaal Soils: Highveld Black Turf	
*36	Representative Transvaal Soils: Waterberg Sandy soil	
*37	Toxicity of locusts poisoned with arsenical baits	
*38	Influence of the admixture of different grades of limestone on the solubility of phosphoric oxide in superphosphate	
*39	Preliminary note on the South African poison acocantherine	
*40	Colouring matter in polysaccum crassipes D.C.	
*41	Seasonal variation of nitrates in the black turf at Onderstepoort	
*42	A note on the use of waste alcohol in the calibration of Babcock milk and cream test bottles	
*43	Manures and farm foods: Their composition and valuation	3d
*44	Some metamorphic mudstones	
*45	Some further remarks on tobacco cultivation for nicotine	3d
*46	On the formation of soil from diabase in the Central Transvaal	
*47	Origin of black turf soils in the Transvaal	
*48	Saaidam terraces in the Karroo	
*49	On the nicotine and ash constituents of the leaf of the tobacco plants grown at Rustenburg Tobacco Experiment Station, Season 1921-22	
*50	A contribution to our knowledge of the function of nicotine in the tobacco plant	
*51	Profitable potato production	
*53	Some experiments on the solubility of Saldanha and Grahamstown phosphates in the soil	3d.
*54	Additional notes on the active principles of South African plants	
*55	Comparative results of analysis of spirits and brandies	
*56	Some experiments in soil inoculation within the Union	
*57	More notes on the acocantherine	
*58	Amount of strychnine in poisoned finches	
*59	The problem of Noors honey	
*60	Chemical investigations in regard to citrus	3d.
*63	Soil Formation and classification	
*64	On the composition of the fractions separated by mechanical analysis from some Transvaal soils	
*65	Co-operative fertilizer experiments with potatoes	
*66	Fumigation with hydrocyanic acid gas	3d.
*68	Solubility of copper in basic copper carbonate	
69	Cotton fertilizer trials	3d.
69	Katoenmisproewe	3d.
*70	How far does superphosphate penetrate soil	

Obtainable from the Librarian, Division of Chemical Services, Private Bag, Pretoria.

*** indicates that only English copies are available.**

Control of Cochineal in Spineless Cactus Plantations.

Dr. F. W. Pettey, Senior Entomologist, Officer-in-Charge, Biological Control of Prickly Pear.

ALTHOUGH *Cactoblastis cactorum*, since it was first liberated in the veld in 1933, has accomplished considerable damage to prickly pear by destroying much of the succulent growth, by completely killing young plants, by reducing the fruiting capacity of this weed, and by greatly retarding its spread, it has nevertheless failed to attain the full purpose desired, mainly because it cannot thrive in the woody parts of its host plant. In considerable portions of the eastern Cape Province flesh-eating ants have prevented this insect from making any progress at all. The Department of Agriculture and Forestry has, therefore, decided to introduce another insect enemy of the prickly pear to assist *Cactoblastis* in the destruction of this pest, and about four years ago the cochineal, *Dactylopius opuntiae*, was imported from Australia.

This cochineal has now been distributed throughout all the pear-infested areas of the eastern section of the Cape Province and in other parts of the Union where prickly pear is a potential menace. The insect has accomplished excellent destruction of the plant by greatly reducing the density of its growth and has completely destroyed many large plants and woody branches.

Cochineal Damage to Spineless Cactus.

Unfortunately, *D. opuntiae* also attacks and causes damage to the spineless cactus species and may, sooner or later, spread to and invade spineless cactus plantations, and, if left undisturbed, will effect a considerable degree of injury to the plants, although not completely destroying them.

The object of this article is, therefore, to acquaint owners of plantations with this insect in order that they may detect it and prevent its spread if it should appear there.

Description of the Cochineal.

Dactylopius opuntiae is similar in appearance, habits and life-cycle to other species of cochineal.

The cochineals are commonly called mealy bugs on account of their white, mealy or waxy covering. They deposit their eggs in loose masses, covered with a waxy secretion, and the clumps appear to be like small masses of snow-white cotton-wool.

For the first few weeks following hatching, the two sexes resemble each other. When hatched, they are no larger than a grain of fine table-salt, elliptical in shape, dull pinkish-red in colour and not easily recognized, unless by means of a magnifying glass. The males soon crawl to rough spots on a leaf pad or on the stem of the plant, and then spin tiny white elliptical or barrel-shaped cocoons in a cluster. In warm weather they will emerge after a few days as very small, two-winged insects, having two long, white threads at the end of the body. Owing to their small size, they are seldom seen unless one is searching for them. The females, however, continue their development, unchanged in form. They, like the larvae or young stage, have no wings throughout their whole life. When mature, they are widely oval, rather flat and covered with a dense

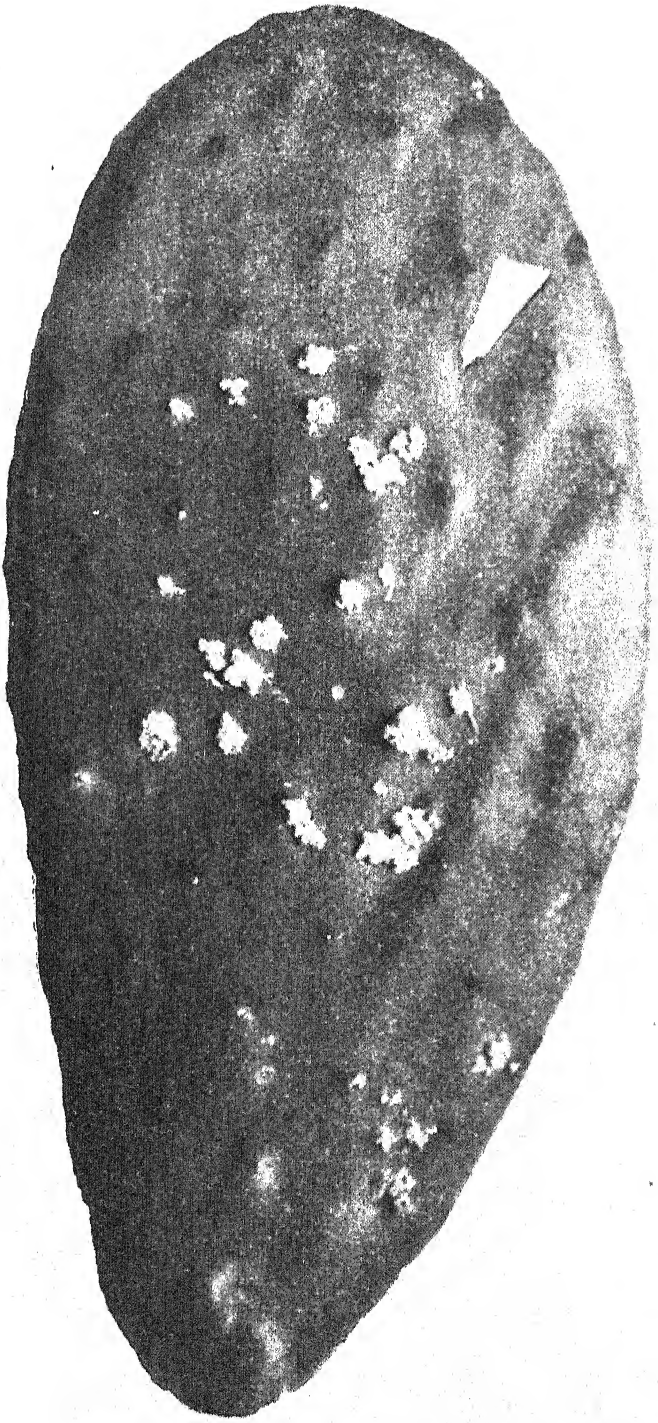


FIG. 1.—Cochineal on Spineless Cactus.

white powdery wax. The mature and immature females resemble the larvae, except in size and colour. In a few days the females lose all power of movement, have no wings, and they crawl only a few inches for the rest of their life period, but during the short time when they can move, they may crawl on to a beetle, large insect, a bird's foot that may happen to perch near it on the plant, a cow, a goat, baboon, monkey or any other large animal which may happen to come in contact with them while passing, resting or feeding. The tiny young cochineals may even be carried away to another plant in the plantation by these means or even by a very strong wind. There-

FIG. 2.—Cryptolaemus beetles eating the Cochineal (*Dactylopius opuntiae*).

fore, to prevent the spread of the cochineal through the plantation, any infested leaf pad should, when discovered, be removed immediately and destroyed completely, either by feeding it to stock or by some other method such as burning.

It is only the females which cause damage to the plant; they have needle-like mouth parts, by means of which they suck the sap and they are very toxic to the plant tissues. The females occur on the plant singly or in small white clumps. A single mature female is only about one-tenth of an inch long.

If the cochineal reaches a plantation, it will arrive there in very small numbers and will generally appear only on one or a very few leaf pads of a single spineless cactus plant. The presence of the insects can easily be detected, as shown in Figure 1. The infestation is very conspicuous and will appear as small, irregular clumps of white, cotton-like masses. These masses may comprise all stages of the insect.

Prompt Eradication of Cochineal.

It is impractical to eradicate cochineal in a plantation after it becomes well established there and has spread over an appreciable area. As yet there is no spray material which can be used commercially or which is weak enough to avoid injury to the plant, or strong and penetrating enough to kill all stages of the insect and at the same time be sufficiently cheap to be practical, and which will eradicate or even satisfactorily control any species of cochineal.

Once the cochineal population is well established an appreciable measure of control, even if it could be obtained by spraying, would necessitate repeated applications annually, and this would be too costly to be practical for such a crop as spineless cactus. Furthermore, such partial control would only result in a certain and gradual spread of the infestation throughout the plantation.

The insect should, therefore, be completely eradicated as soon as its presence is detected in a plantation and before it has spread to and infested many spineless plants. The owner of a plantation should regularly inspect his plants to detect an infestation shortly after it appears. If the insect's presence is detected while it has infested only a few leaf pads, these pads should be removed and promptly disposed of. If other parts, i.e., the stems or branches of just a few plants, also become infested, the infested pads should be removed and destroyed by feeding them to stock or by burning them, and the insects on the stems or other plant parts should be eradicated by applying heat to them by means of a blow-lamp. Several inspections should be made later at short intervals and the same measure should be repeated if any new infestations appear which were overlooked previously. Thorough work should easily be successful at little cost, *and the work must be thorough if it is to be of any use.*

Sweating Sickness in Calves:—

[Continued from page 330

weather conditions and time of the year under which the disease appears; (*e*) nature and condition of the veld, and methods of calf rearing; (*f*) the extent and type of tick infestation, also the dipping programme as applied to calves; (*g*) differences in the incidence of sweating sickness amongst European-owned calves, as compared with native-owned stock—more particularly the distribution of sweating sickness in native reserves; (*h*) form of treatment and preventive measures applied locally; (*i*) any additional information which may be of value. Detailed information concerning the above points is to be submitted to the Director of Veterinary Services, Onderstepoort.

As a result of the irregular appearance of sweating sickness and the peculiarity of the symptoms, great difficulty is experienced in conducting detailed investigations.

Consequently the solution of sweating sickness as a problem is largely dependent upon the co-operation of cattle farmers and field officers, and hence this urgent appeal to all who can supply information.

The Nutritive Value of Skimmed Milk, Buttermilk and Whey.

P. G. van Rensburg, College of Agriculture, Cedara.

FARMERS do not seem to attach much importance to skimmed milk and whey, and make only scant use of buttermilk. These dairy by-products are seldom converted into profits, and if we were to attempt a calculation of the total wastage of these products in the country as whole, the final figures would be startlingly high. The actual direct loss may not be so extensive, but together with the indirect loss brought about by the ineffective use of these products, it assumes large proportions.

These losses are brought about chiefly by failure on the part of dairy-farmers to appreciate the nutritive value of these products, and it is generally assumed that, once this state of affairs has been remedied these products will be put to much more profitable use.

Skimmed Milk.

Skimmed milk differs from normal milk mainly in that most of its fat content has been removed. The following are the constituents of milk and skimmed milk respectively:—

	Water.	Fat.	Casein.	Albumin.	Lactose.	Mineral Salts.	Total Solids.
	%	%	%	%	%	%	%
Milk.....	87·1	3·9	2·5	0·7	5·1	0·7	12·9
Skimmed Milk...	90·3	0·1	2·75	0·8	5·25	0·8	9·7

From the above it is clear, that those constituents of milk which are necessary for growth and development are present in the same percentages in skimmed milk as in normal milk. Skimmed milk is, therefore, just as suitable for the feeding of young animals as whole milk. The fat which has been removed can be supplemented by the addition of other protein constituents, provided regard is had to the fact that milk-fat contains vitamin A. The latter must, therefore, be supplemented when skimmed milk is fed.

Buttermilk.

The following is the composition of buttermilk as compared with that of whole milk:—

	Water.	Fat.	Casein.	Albumin.	Lactose.	Mineral Salts.	Lactic Acid.	Total Solids.
	%	%	%	%	%	%	%	%
Milk.........	87·1	3·9	2·5	0·7	5·1	0·7	—	12·9
Buttermilk...	90·6	0·1	2·8	0·8	4·4	0·7	0·6	9·0

This table illustrates the close approximation between the percentage of the constituents of milk and those of buttermilk. In the the case of the latter, of course, fat has been removed in the buttermaking process. When utilizing buttermilk as a feed, provision must, however, be made for carbohydrate substitutes, since not only has fat been removed, but there has also been a reduction in the lactose content as a result of the formation of lactic acid.

The solids content is approximately 9 per cent., as against 12·9 per cent. in whole milk. The proteins which constitute 3·6 per cent. are of high quality and easily digestible. The lactic acid in buttermilk has a very beneficial physiological effect on the digestive system.

Whey.

The following is the composition of whey as compared with that of milk:—

	Water.	Fat.	Casein.	Albumin.	Lactose.	Mineral Salts.	Lactic Acid.	Total Solids.
	%	%	%	%	%	%	%	%
Milk.........	87·1	3·9	2·5	0·7	5·1	0·7		12·9
Whey.......	93·0	0·35	0·1	0·75	5·0	0·8	0·25	7

At first sight, this table gives the impression that whey is very inferior as a feed. Actually it has a very low protein content, since not only the fat, but also the casein, has been removed in the form of cheese, with the result that the total solids content has dropped to 7 per cent. As the lactic acid in the whey increases there is a more or less corresponding decrease in the lactose content, but the digestibility of whey and its beneficial effect on the digestive system, mainly on account of the enzymes, rennin and pepsin, derived from the curd, make it an important nutrient. In cheese-making, 51 per cent. of the total solids content of milk is taken up by the cheese, 49 per cent.—in other words almost half—remaining in the whey.

In present circumstances it is imperative that the best use should be made of all available foodstuffs for human beings as well as animals.

The value of the above by-products of milk cannot be over-estimated. If they cannot be utilized for supplementing the meagre diet of large numbers of labourers, they can be applied to improve the rations of calves, pigs and poultry, especially now that farmers are experiencing such difficulty in obtaining the usual feeds.

In connection with these by-products, Dr. W. H. Sebrell, Chief, Division of Chemical Services, Department of Public Health, U.S.A., declared in the "National Butter and Cheese Journal" (September 1942), that some method or other would have to be found for making these valuable nutrient materials available to that section of the population which is unable to obtain whole milk. These products should on no account be utilized for non-feeding purposes, unless all food requirements have been satisfied.

Popular Bulletins.

(1) Calf Rearing—Bulletin No. 224. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

(2) The Export of Fresh Grapes from the Union of South Africa during the Ten-year period, 1930-39—Bulletin No. 225. Price 6d. Obtainable from the Chief, Division of Horticulture, Pretoria.

(3) Soft Cheese as a Food—Bulletin No. 229. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Effect of Rumen Contents on the Growth of Chickens.

P. J. Serfontein (Poultry Research Officer) and Dr. J. J. Bronkhorst, Senior Professional Officer (Poultry).

SINCE wheaten by-products, lucerne leaf meal, dried milk, liver meal, dried brewer's yeast and other feeds with a high flavin content are not obtainable at all or only in limited quantities for the feeding of poultry, most of the available rations do not contain enough of this essential vitamin which is probably the most important portion of the B-complex group for the feeding of poultry. In our research for good sources of flavin it was learned from published articles that certain vitamins of the B-Complex are synthesized in the rumen or first stomach of sheep and cattle. Tests were consequently carried out with this material.

The main difficulty in connection with the rumen contents is to find a practical and inexpensive method of drying it without affecting its flavin content. Arrangements were, therefore, made with Mr. van Aswegen, Chief Veterinary Officer at the Pretoria Municipal Abattoir to prepare a sample of rumen contents. The product was first treated with diluted hydrochloric acid and the pH reduced to about 4·75 since it had already been proved that flavin is resistant to heat provided the reaction is acid. This sample of rumen contents was then sterilized and dried in the ordinary steam drier used for the manufacture of carcase meal. The dried material was then ground in a hammermill and added to the poultry rations. The rations used are given in Table 1.

TABLE 1.

	Ration 1. Negative Control.	Ration 2. 5 per cent. Rumen Contents.	Ration 3. 10 per cent. Rumen Contents.	Ration 4. Positive Control.
	lb.	lb.	lb.	lb.
Yellow mealie meal	56	50½	45	54½
Wheaten bran	10	10	10	10
Oatmeal	10	10	10	10
Concentrated fishmeal	17½	18	18½	15
Rumen content	—	5	10	—
Bone meal	1	1	1	1
Lime oyster-shell powder	1	1	1	1
Cod-liver oil	1	1	1	1
Molasses	3	3	3	3
Salt	½	½	½	½
Brewer's yeast	—	—	—	4
$MnSO_4$	½ oz.	½ oz.	½ oz.	½ oz.

Table II supplies full details regarding growth, feed consumption, mortality and symptoms of vitamin deficiency. The latter figures clearly show that even the addition of 10 per cent rumen contents, prepared as shown above, does not furnish sufficient flavin to supplement a meal ration with a serious flavin deficiency to the same extent as 4 per cent. dried brewer's yeast. Rumen contents do contain a certain amount of flavin but not enough (even on a 10 per cent. basis) to provide the relatively high percentage required. The percentage fibre in rumen contents is so high that it will retard

 [Continued on page 345.

Coccidiosis (Red Diarrhoea) in Cattle.

Dr. M. W. Henning, Professor of Veterinary Science,
University of Pretoria.

IN an article on calf paratyphoid,* which is one of the most serious diseases in calves in South Africa, I pointed out how stock owners are sometimes inclined, without sufficient evidence, to attribute all their losses in calves to paratyphoid when the cause may actually be some other disease, such as heartwater, gallsickness or redwater.

During the past year or two, more and more losses in calves have been brought to our notice where neither paratyphoid nor any of the tick-borne diseases could be incriminated. When paratyphoid vaccine was used in these cases, it was found to be of no avail. In a number of these outbreaks coccidiosis was found to be the cause of the mortality, and it is, therefore, considered advisable to give a detailed description of this disease.

Nature of the Disease.

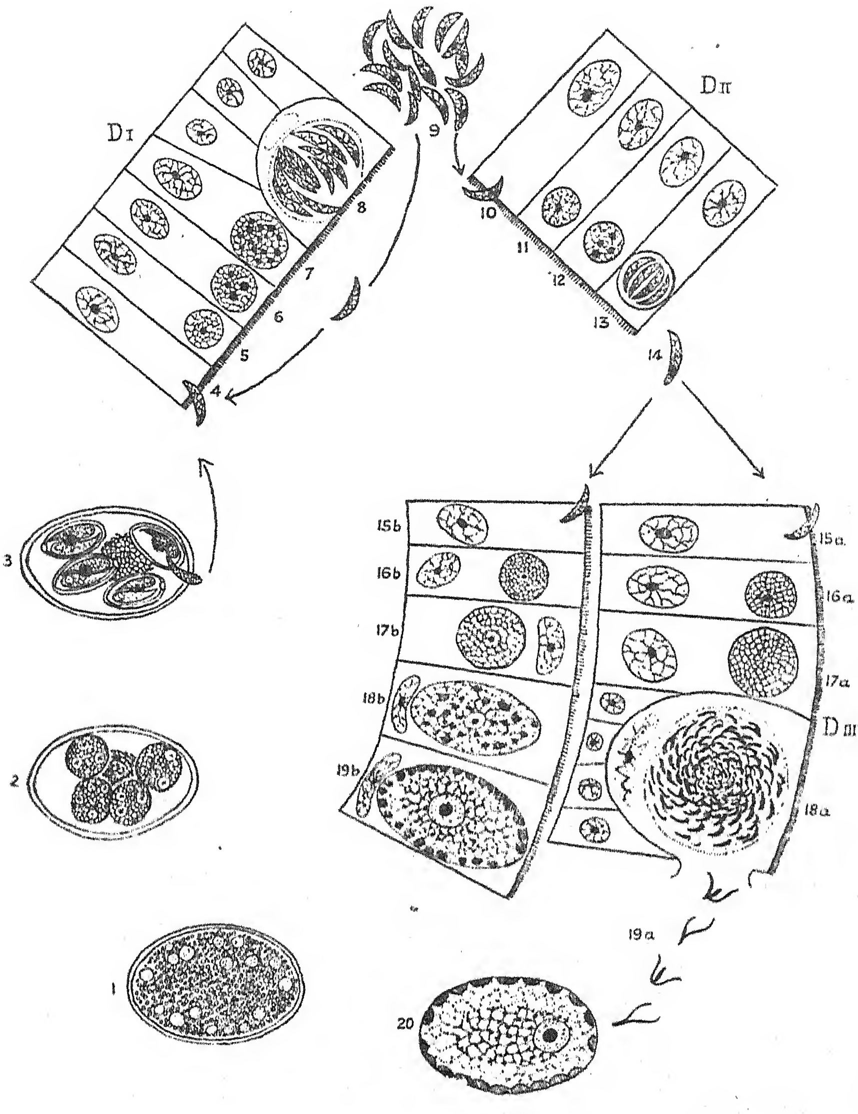
Coccidiosis is an infectious disease of cattle caused by a parasite, the coccidium, which invades the digestive tract, mainly the large intestine. It affects mostly young bovines and give rise to bloody evacuations.

A number of species have been incriminated, but the most common cause of bovine coccidiosis is a coccidium known as *Eimeria zürnii*, named after the Swiss Veterinarian, Zurn, who was the first to describe this disease in cattle.

The Life Cycle.

Coccidia are generally eliminated as oocysts (1) with the faeces from the body of the host. These oocysts are small round or oval cells with a very thick and resistant wall. They are about 3 or 4 times the diameter of a red blood cell. When the oocyst arrives in a favourable environment, it undergoes a process of ripening or spore formation (sporulation). Inside its thick wall, four sporoblasts (2,3) are formed and each sporoblast gives rise to two banana-shaped sporozoites (3,4) i.e., each sporulated oocyst contains 8 sporozoites (see illustration). By contamination of the food and water, the sporulated oocyst (2,3) is ingested by the host. In the intestine the sporozoites are liberated from the oocyst. They move about freely and penetrate into the epithelial cells of the intestinal mucous membrane (4). Here the merozoites grows into a round body (the schizont) (7,8). The schizont divides and gives rise to a number of banana-shaped merozoites (8,9). The epithelial cell ruptures and liberates a number of merozoites (9) which again move about in the intestine and invade new epithelial (10) cells. They again form round schizonts (11, 12, 13) which give rise to more merozoites. This is known as the asexual cycle of multiplication, DI, DII and it may proceed for a certain number of generations until finally a generation of merozoites is formed which develops into cells known as gametocytes. These gametocytes are the precursors of male and female cells. The male gametocyte divides to form a number of free swimming male cells (15a-19a) while the female gametocyte enlarges and forms a wall around it with a small pore at one end. Through

* See *Farming in South Africa*, Sept. 1941.



D. In the intestine of host.—(1) Oocyst before sporulation (inside intestine of host and in faeces when excreted); (2) mature or sporulated oocyst with 4 sporoblasts, outside the host; (3) liberation of sporozoites when the oocyst reaches the intestine of the host. Each oocyst contains altogether 8 of these banana-shaped sporozoites; (4) penetration of epithelial cell in the intestine by the sporozoite; (5) to (8) development of parasite in the cells of the intestinial wall. Asexual development; (8) a schizont with a number of merozoites before rupture of the cell; (9) the merozoites now liberated to penetrate new epithelial cells; (10) to (13) repetition of the asexual development which occurs within 5 to 8 days; (14) a merozoite which either repeats the asexual development in 10-13, or changes into a precursor of the male and female gametocyte. In this way the sexual development (gametogenesis) 15 to 19, appears; (15) (*b*) to (19) (*b*) development of female gametocyte in the epithelial cells of the intestinal wall; (15) (*a*) to (19) (*a*) development of male gametocyte; (18) (*b*) to (20) the female macrogametocyte matures and becomes encysted. It now becomes an oocyst which leaves the epithelial cell to lie free in the intestine and to be fertilized by the male gametocyte; (18) (*a*) a number of male microgametocytes develop and are liberated in the intestine (19) (*a*). Each male cell has two flagella and swims about in the intestine until it meets a female macrogametocyte with which it fuses to form a zygote (fertilized oocyst). A hard, thick wall forms around the fertilized oocyst. The oocyst (1) is now ready to be excreted in the faeces where it sporulates or ripens under favourable conditions (1, 2, 3); (19) (*a*) ripe male gametocytes with two flagella which swims about freely in the intestine in search of a female gametocyte with which to fuse (20).

this pore a male cell enters to fuse with the female cell (20) and form a fertilized cell of zygote. After a thick wall has formed around the fertilized cell it becomes the oocyst. The oocyst is now evacuated with the faeces, but it is not infective immediately. If it encounters suitable conditions as regards temperature and moisture it will develop into a sporulated or ripe oocyst. Inside each oocyst, four sporoblasts each containing two sporozoites, develop before it is ripe and infective, and before it can be called a sporulated oocyst.

Environmental Factors.

For sporulation or ripening, the oocyst requires a certain time which is determined by favourable physical and chemical conditions. Extremes of temperature are unfavourable. In very cold and very hot surroundings, the oocyst will not sporulate. When heated over 50° C. all the oocysts will perish. Desiccation and sunlight are detrimental to the oocysts, but moisture and moderate heat are essential for their development. A moist dirty stable floor, contaminated with infested faeces, is, therefore, a very favourable environment for the development of oocysts; air or oxygen is also beneficial. Under optimal conditions of heat and moisture, the infective stage may be reached in 2 or 3 days, but under less favourable conditions sporulation will not take place unless at least 2 or 3 weeks have elapsed. Under natural conditions the infective stage is usually reached about 1 to 2 weeks after the oocysts have been evacuated by the host.

Provided there is sufficient moisture, sporulation (ripening) will proceed very rapidly between 25 to 30° C., but it will be very slow if the temperature falls below 15° C. If kept in a moist medium at a temperature above -2° C. and below 37° C. the oocysts will remain alive for at least a year, provided they are not exposed to the action of bacteria.

Putrefaction of the surrounding medium is detrimental to the oocysts, and bacterial growth may be regarded as the most important factor in the natural destruction of the oocysts. The heat which is evolved during the fermentation of a compost or manure heap is so great (up to 60° C.) that very few oocysts present in the manure will escape destruction.

But the oocysts are remarkably resistant to many chemicals which are highly bactericidal, e.g., the oocysts will withstand 0·1 per cent. potassium permanganate, 0·1 per cent. corrosive sublimate, 5 per cent. formalin, 5 per cent. phenol, 5 per cent. copper sulphate. The use of chemical disinfectants for the destruction of oocysts in contaminated quarters will, therefore, be of no avail.

Transmission.

Recovered animals are immune, but they owe their immunity to the retention of the parasite in their bodies. They remain carriers and spread the disease by constantly discharging small numbers of oocysts with their faeces. They are, therefore, an important source of infection. But oocysts may also be passed in small numbers by apparently healthy animals in both infected and healthy herds. About a year ago an eight-months' old Friesland heifer at the University Farm suddenly developed an acute attack of red diarrhoea. On examining the bloody discharge, large numbers of oocysts were found. This is the first and only case of coccidiosis ever recorded on this farm.

With a view to preventing gross contamination of the University Farm, the animal was removed to Onderstepoort, where it could

be kept under observation. It was placed in a clean loose box and it made an uneventful recovery in a week or two without any treatment. Four other year-old Friesland heifers that had been running under identical conditions with the affected one, never developed clinical symptoms of coccidiosis, but an examination of the faeces showed that every one was discharging oocysts in small numbers.

It appears that natural infection usually occurs as a result of more or less continous ingestion, over a long period, by susceptible animals of small numbers of oocysts of which some, at least, must be sporulated. There is probably some unknown predisposing factor which favours infection under natural conditions. When this factor is not operating, infection does not take place. This is probably the reason why it is sometimes difficult to set up a severe infection experimentally, even by employing massive doses of oocysts.

Susceptibility.

Coccidiosis generally appears in its most virulent form in very young animals. Older animals are usually less susceptible, as they have often acquired a certain amount of immunity at an earlier age.

In some outbreaks infection may occur soon after birth, and blood may appear in the faeces in 3 to 6 weeks time, but clinical symptoms are seldom noticed before the calf is 2 to 3 months old. It is frequently the strongest, healthiest and the most robust calf that suffers first. If the disease has once made its appearance, it may spread very rapidly and effect a number of calves in a short time, unless suitable hygienic measures are promptly taken. It is most remarkable, however, that if a number of animals are exposed to the same conditions, only a certain number will develop clinical symptoms of coccidiosis, the others remaining apparently healthy; but should the faeces of the latter be examined, oocysts will be found.

Although young animals usually suffer the worst from coccidiosis, adults may sometimes also be badly affected. The writer has seen several very severe and fatal cases of coccidiosis in adult cattle grazed on the heaths in parts of Cornwall, England.

Coccidiosis has frequently been reported in store cattle brought in from the veld to be fattened in a pen or enclosure. The hygienic conditions under which these animals are kept frequently leave a great deal to be desired, and it may be possible that the environment is favourable for the operations of those unknown predisposing factors already mentioned.

Symptoms.

The incubation period is commonly regarded to be about 3 weeks, but occassionally it may be barely a week, or it may be as long as 1 or 2 months in animals transferred from the stable to infected veld.

As stated above, it frequently happens that the healthiest, strongest and most robust calves first go down with symptoms. The severity of the symptoms may vary in different cases, but the predominant symptom is always diarrhoea. As the disease progresses, the scouring becomes more and more severe until evacuations are thin, watery and bloody. The discharge evacuated under great strain may contain flood blood, blood clots, mucus and shreds of epithelium that have peeled off. After a few days the evacuations become foetid, greenish black, with more shreds of epithelium and clots of blood. The straining becomes more and more severe and painful, sometimes leading to prolapse of the anus. The animal is now forced into a characteristic posture with its back arched, its abdomen tucked up,

its legs drawn together, its coat staring, its head held low; and it becomes dull and listless and grinds its teeth intermittently, while its eyes are deeply sunken and saliva is dribbling from its mouth.

At first the appetite is fair, but as the disease progresses any inclination to eat is completely suppressed. The animal loses condition rapidly and as a result of extensive loss of blood, it becomes weak and anaemic. Finally it dies from extreme weakness and exhaustion.

Sometimes there is no haemorrhage and no blood in the faeces, yet the animal loses condition and becomes weak and debilitated.

Oocysts are always found in large numbers in the faeces during the acute stage.

Course.

Mild cases recover rapidly. This happens particularly with older animals, in which the intestinal haemorrhage ceases after a day or two and the diarrhoea soon afterwards. The average duration is about 5 to 10 days, but in very severe cases the animal may die in 24 to 48 hours. Occasionally the condition becomes chronic, but the patient pines for months until it finally dies from debility, as in the case of paratyphoid. Sometimes pneumonia and nephritis may set in as complications.

The mortality varies considerably. It may be as high as 50 per cent. and as low as 3 to 5 per cent.

Lesions.

The most striking lesion is the intense redness of the intestinal mucous membrane. So much of the epithelium is destroyed that some of the small blood vessels open directly into the lumen of the intestine, resulting in the profuse haemorrhage which is such an outstanding symptom. The mucous membrane is swollen, corrugated and denuded of epithelium in large parts and its surface is covered by a semi-fluid, bloody material containing blood clots and shreds of epithelial debris.

The large intestine is always the most seriously affected. Sometimes the lesions extend into the last part of the small intestine, but the major portion of the small intestine seldom shows alterations that can be recognized with the naked eye.

Large numbers of the parasite may be found in the bloody contents of the large intestine.

Immunity.

Animals which have recovered from an attack of coccidiosis are considered to have developed a strong resistance to infection with the same parasite. If an animal, which is known to have recovered from an attack of coccidiosis, should contract the same disease again, an examination will show that another species of the parasite will usually have to be incriminated as the cause. What immunity an animal develops after an acute attack is probably associated with the persistence of coccidia in the digestive tract after a clinical recovery. The recovered animal has acquired a tolerance and remains a carrier of coccidia for an indefinite period; it may, therefore, be responsible for infection of susceptible animals from time to time. The presence of carriers in a herd is probably the most important factor in the dissemination of coccidia.

Older animals frequently discharge small numbers of oocysts with the faeces and thereby disseminate the infection, particularly if

pastured in warm, marshy places. Sometimes these may be animals which have never yet shown clinical symptoms of coccidiosis.

Coccidiosis is a disease which is strictly host-specific. Coccidia which are pathogenic to cattle are limited to bovines and cannot be transmitted to other species of animals like sheep, goats, pigs, rabbits and fowls. Likewise, coccidiosis of any of these animals is strictly specific for that particular animal.

Diagnosis.

When a young animal suffers from diarrhoea which is associated with the evacuations of blood, mixed with mucus and shreds of epithelium, coccidiosis should be suspected. But a positive diagnosis can be made only by the recognition of large numbers of oocysts in the faeces. When the oocysts are present in small numbers, these parasites are probably not the main cause of the diarrhoea, and other contributory causes must be looked for.

For the diagnosis of coccidiosis, therefore, it is advisable to submit the following specimens to the laboratory:—

(1) In the living calf, portions of the bloody discharge and mucus are collected in 1 per cent. bichromate solution or in a solution of boric acid.

(2) If the calf has died, a piece of the intensely red intestine is removed and tied at each end so as to retain the contents. This is then placed, together with a piece of liver and spleen, in 50 per cent. glycerine. The liver and spleen are required for the determination of paratyphoid, which is frequently confused with coccidiosis.

The specimens can also be sent in 10 per cent. formalin or 90 per cent. alcohol. But the formalin and alcohol may destroy the causal organisms without interfering with the value of the specimens for purposes of diagnosis.

Conditions with which Coccidiosis may be Confused.

(1) *Paratyphoid.*—Whereas paratyphoid usually affects young calves from 1 week to 3 months old, coccidiosis is more often found in calves from 2 to 3 months old and older. Moreover, in paratyphoid the diarrhoea is usually yellowish-grey and dirty, whilst it is bloody in coccidiosis. The mortality in paratyphoid is always much higher than in coccidiosis, and the affected calf seldom recovers. In coccidiosis, recoveries are fairly common if the sick calf is suitably treated. If a calf recovers from paratyphoid it usually looks unthrifty for some time and pines for several months; in coccidiosis the calf may sometimes pine and remain unthrifty after clinical recovery, but in South Africa the majority of calves that have recovered from an acute attack of coccidiosis usually recuperate fairly rapidly and regain most of the condition lost in the course of a few weeks.

(2) *Heartwater.*—The losses from heartwater are also considerable in South Africa, but heartwater occurs in certain areas that are fairly well-defined topographically. Moreover, heartwater infection is affected by the bite of the bont-tick which is practically limited to the tropical and sub-tropical areas. Outside these areas heartwater occurs only sporadically, i.e., when infected ticks have been carried with animals from infected low veld and middle veld localities, whereas coccidiosis may occur in any part. Although diarrhoea may be a symptom of heartwater, as in paratyphoid and coccidiosis, the most striking symptoms are excitability and other disturbances of the nervous system.

(3) *Arsenical Poisoning.*—In arsenical poisoning, the animal usually suffers from a very severe diarrhoea, which may also cause the evacuation of blood and mucus, but the course is always very rapid, and death usually occurs in a day or two. As in the case of coccidiosis, there is redness of the mucous membranes of the intestine, but the redness is less intense than in coccidiosis and occurs throughout the small and large intestine, whereas it is limited mostly to the large intestine in coccidiosis; in arsenical poisoning there is usually also reddening of the fourth stomach. The presence of arsenic can be determined by an analysis of stomach contents and parts of the liver, while for a diagnosis of coccidiosis the bloody contents of the large intestine should be examined for oocysts.

(4) *Scours.*—Diarrhoea in calves can be caused by irregular and improper feeding or by feeding materials that cause irritation of the intestine. Examination of the intestinal discharges and of portions of liver and spleen will be able to exclude both coccidiosis and paratyphoid.

Prophylaxis.

For the adoption of reliable prophylactic measures, conditions should be created that are as unfavourable as possible for the existence of the parasite and for its transmission from animal to animal. As pointed out above, the most important factor in the maintenance of coccidiosis infection is the carrier animal. By eliminating the carrier or by rendering its faecal discharges innocuous, transmission of coccidiosis to young susceptible animals will become very difficult.

Under conditions of ordinary temperature and moisture and a free supply of air the oocyst requires a minimum period for its sporulation, i.e, for reaching the infective stage. The species of coccidium affecting the bovine needs about two weeks, but some of the species found in some of the smaller animals require barely 30 hours before the infective stage is reached. When kept within the limits of −2° C. to 37° C., the oocysts will live for about a year, provided they are not desiccated or exposed to the action of bacteria or the rays of the sunlight.

As the oocysts are remarkably resistant to the action of most of the common chemical disinfectants, disinfection of contaminated material will be of no avail in preventing infection. Prophylactic measures should, therefore, be adopted which would prevent the ingestion of a sufficient number of oocysts that would be capable of setting up clinical symptoms. It will not be possible to prevent animals, kept under ordinary farming conditions, from picking up a certain number of oocysts; but provided large numbers of oocysts are not ingested in a short period, or smaller numbers continuously over a long period, the animal is not likely to develop clinical symptoms. If a small number of oocysts are picked up the animal is unlikely to suffer serious disturbance of health, the few parasites are more liable to confer a certain amount of immunity on the animal than to effect it detrimentally.

There is no practical method which can be entirely relied upon for the complete destruction of the oocysts. It is only by adopting simultaneously a number of different measures that it will be possible to limit the infection.

(1) *Hygienic Measures.*—The most stringent hygienic measures must be carried out in the stable. The stables used must be well constructed with sloping concrete floors. No manure should be

allowed to accumulate and the stable floors must be thoroughly cleaned and dried every day. If the floor of one stable cannot be dried during the course of the day, two stables should be used on alternate days for housing the animals, the one stable being used while the other one is drying. If the infection is severe on a farm, it may be advisable to keep the calves stabled until they are about 6 months old. Their water and food must be beyond reproach and should be renewed at least once a day. When the animals are allowed out to graze, they should not come in contact with manure or infected camps, particularly if there are pools of water and marshy patches in the camps.

If stall-fed animals become infected, the same precautions should be taken. When it is not possible to provide suitable stabling facilities, the animals should be tied up next to the manger in such a way that they cannot pick up particles of manure or contaminated food or water.

(2) *Disposal of the Manure.*—If the manure is regularly removed from the stable and exposed to conditions that would encourage fermentation, as in the manure or compost heap, the heat evolved during the fermentation will raise the temperature of the manure to 50 or 60° C., which is detrimental to the oocyst. The majority of oocysts will be destroyed in this way and those that have remained in the stable will probably also perish from desiccation if the floors are given time to dry. It is the infected animal, showing clinical symptoms, which is most dangerous, and it should be kept isolated in a suitable stable so that its evacuations can be properly treated in the manure heap.

(3) *The Infected Veld.*—If there is enough moisture in the veld where infected animals have grazed, conditions will be favourable for the propagation of the disease. Marshy places and pools of water should, therefore, be drained wherever possible and young animals should not be admitted into the infected areas until these have been kept free of bovines for at least a year.

(4) *The Carcase.*—It is not necessary to burn the carcase of an infected animal. If it is kept unopened, the decomposition that normally ensues will destroy the oocysts present in the intestine.

Treatment.

Although prophylaxis is the only effective method of dealing with coccidiosis, the treatment that the sick animal receives and the thoroughness with which the evacuations are disposed of will influence the course of the disease.

(1) *General Treatment.*—The sick animal must not be allowed to run about in the veld or in a camp, it should be housed in a stable or stall with a sloping concrete floor and if possible placed in alternate stables every other day. The one stable is thoroughly cleaned and the floor is allowed to dry—it was pointed out above that desiccation is detrimental to the oocysts. The sick animal is transferred to the clean stable in the morning, while the stable occupied by it during the night is thoroughly cleaned and allowed to dry for use the following day. The manure is placed in a manure or compost heap where it can undergo fermentation. The water used for cleaning the stable should be suitably disposed of so that the oocysts contained in it cannot be spread. If the animal is housed, the oocyst can be gathered and destroyed, but if it is allowed to run free, the oocysts will be disseminated and so favour the persistence of the infection.

If it is not possible to provide suitable stabling facilities, the sick animal should be tied up in such a way that its manger or feeding trough cannot be contaminated by manure or soil.

In all cases the animal should receive clean food and water and also clean bedding. Every precaution should be taken to prevent re-infection of the sick animal while it shows clinical symptoms. If it is kept free from re-infection by suitable stabling it may be able to overcome the coccidia and recover spontaneously without medicinal treatment. It is considered that the coccidia become less virulent after a number of asexual generations in the intestine, so that the animal's natural resisting powers limit the asexual multiplication of the parasites. The coccidia decrease in number and the clinical symptoms gradually disappear. The coccidia must undergo a sexual cycle of development, part of which takes place outside the body during sporulation, before re-infection and aggravation of the clinical symptoms can occur. Therefore, by preventing re-infection by the mouth, as advocated above, the sick animal will probably recover. But it will keep on discharging oocysts with its manure for an indefinite period after clinical recovery. It has become a permanent carrier. This carrier state, hoewever, confers on the recovered animal an immunity which will protect it against re-infection.

(2) *Medecinal Treatment.*—Many different drugs have been used from time to time for the treatment of clinical symptoms of coccidiosis. Some of these have been claimed to have given beneficial results. But none of these claims could stand the test when properly tried out. In most cases where drugs have been used, suitable hygienic measures have been adopted simultaneously; it is these hygienic measures rather than the drugs given, that have been responsible for the beneficial results obtained.

However, the administration of some drugs may cause an alleviation of the symptoms. It is particularly astringent medicines that may be useful. Of these, tannic acid is probably one of the most effective. This is a very light powder, and the dose for a calf is about 1 to 3 teaspoonfuls, given twice a day. The tannic acid is given in about ½ a cup of raw linseed oil or a cup of water. Tannic acid enemas will also give some relief, and should be carried out wherever possible. When tannic acid is not available, wattle-bark-extract can be given. A heaped-up teaspoonful of wattle-bark-extract is added to a bottle of water, and a cupful of this is given three times a day.

Recently sulphonamide preparations have been used for the treatment of nearly every disease including coccidiosis. The results obtained with coccidiosis have been most encouraging. Dr. Parkin of Onderstepoort has found one of the sulphonamides, given in the form of enemas, to be specific for the treatment of coccidiosis in dogs. But the large intestine of the dog is very short and the drug will easily pass the whole length of the large bowel when given in a fluid state; the large intestine of the bovine, on the contrary, is a very long and tortuous tube, so that it may not be so easy to get the drug far enough forward in the bowel to obtain the same effect as in the dog.

As some of the most serious lesions may occur in the posterior part of the colon and rectum, the use of sulphonamide enemas may be justified in some cases. For the treatment of coccidiosis in calves, it is advisable to administer one of the sulphonamides, e.g. M & B 693,

prontosil or another sulphanilamide, both by the mouth and by means of enemas. The dose is about 6 grams per 100 lb. weight—or a heaped-up teaspoonful weighs about 6 to 7 grams.

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Effect of Rumen Contents on the Growth of Chickens:—

[*Continued from page 335.*

growth if it is added in quantities large enough to provide sufficient flavin for normal growth. In other words, the fibre content will then become the limiting factor. Signs of this are noticeable in the growth of birds even during the first two weeks. The above-mentioned method of preparing rumen contents is, therefore, of no practical value for supplementing the flavin in ordinary rations.

Since flavin is soluble in water and is, therefore, found mainly in the fluid portion of the rumen contents, it may be possible to obtain a product which will compare favourably with brewer's yeast if the liquid is expressed and dried. Practical difficulties experienced in drying such a watery solution make the preparation of this product impossible at the present time.

TABLE II.

		Group I.	Group II.	Group III.	Group IV.
Average weight at age of 8 weeks	Cockerels...	192·4 gram	355·2 gram	481·2 gram	661·8 gram
	Pullets.....	160·8 ,,	266·8 ,,	359·0 ,,	559·9 ,,
Feed consumption up to 8 weeks		2·14 lb.	2·48 lb.	3·11 lb.	4·25 lb.
Units of feed required to gain 1 unit of weight...............		5·56	3·92	3·67	3·04
Percentage mortality............		17·5	Nil	10·0	2·5
Percentage paralysis due to flavin deficiency....................		37·5	30·0	10·0	Nil
Percentage Dermatitis..........		5	Nil	5	Nil
Number of chickens alive at age of 8 weeks	Cockerels	15	15	18	21
	Pullets..	18	22	16	17

The Harvester Termite.

W. G. H. Coaton, Entomologist, Department of Agriculture and Forestry, Pretoria.

THIS Division is constantly receiving requests from all parts of the Union for a prescription of measures for controlling termites. Fully 80 per cent. of these requests refer to the common harvester termite, of which 8 known species alone exist in the Union.

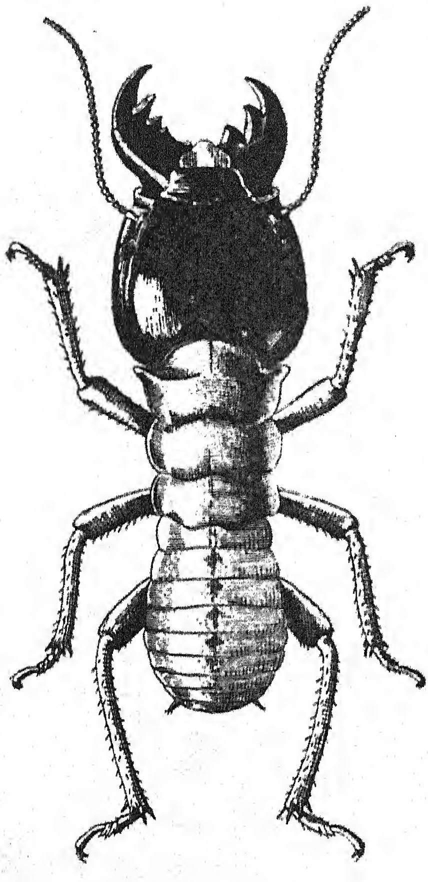

FIG. 1.—*Hodotermes mossambicus* subsp. *transvaalensis*—Soldier.

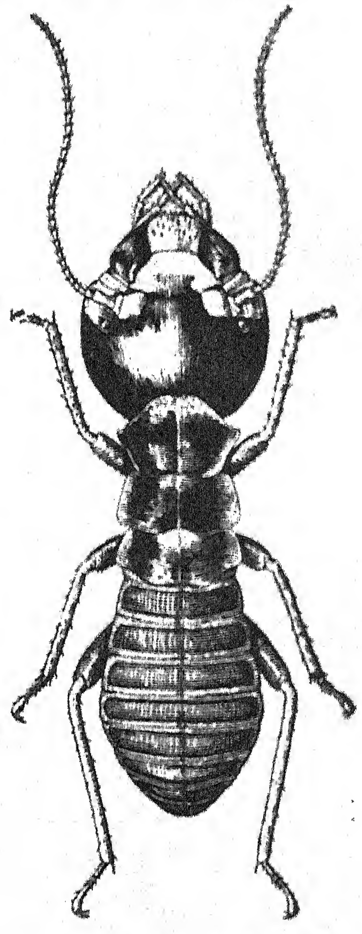

FIG. 2.—*Hodotermes mossambicus* subsp *transvaalensis*—Worker.

Damage Caused by the Termites.

The harvesters do not attack wood, but in gardens great damage is done to lawns, shrubs, young trees and other crops. Wallpaper, books, carpets, curtains and similar articles are often destroyed in houses, while the tunnels which are made in the walls often render the latter unsightly. Unfortunately the greatest proportion of the requests for assistance against this species come from urban centres. Thus-far the farming community has not realized to what extent the grass on pastures is damaged by h rvesters, although this undoubtedly constitutes the most seri[illegible]em of economic damage

caused by this species of termite. In this short article an attempt will be made to discuss this aspect of an important problem, but in order that the problem may be better comprehended such discussion must first be preceded by a description of the biology and organization of the harvester colony.

Organization of the Termites.

The *Hodotermes*, or harvester termites are found in all parts of South Africa, except in the bare rocky mountain areas of the Drakensberg and in the very damp eastern coastal regions of Natal, the Transkei and Pondoland. This termite is familiar to most people, as they have most likely seen thousands of these insects mowing down grassblades and stalks, and carrying the pieces to the numerous small holes in the surface of the ground. Here the hay is deposited to be carried underground when a sufficient supply has been collected, or when the termites are forced to cease their activities as the result of attacks by black ants. The insects which cut grass on the surface, consist of young and full-grown workers. Soldiers which defend the colony are also found, but in smaller numbers than the workers. They have large, protruding jaws and never appear on the surface. While the workers are engaged in hay-mowing, a few soldiers will usually be found directly below the surface in the openings of the harvesting holes, with their jaws directed towards the ground surface in order to keep away intruders, such as black ants. When activities cease, the openings of the harvesting holes are tightly sealed with wet clay by the workers.

The Nest.

Immediately below the ground surface, the harvesting holes lead through a maze of narrow, winding, branching passages into a large series of pockets, approximately three inches in diameter and about

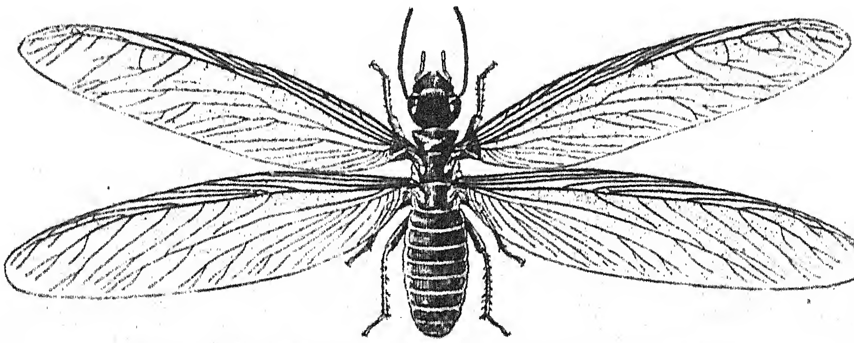

Fig. 3.—*Hodotermes mossambicus* subsp. *transvaalensis*. Alate.

a quarter of an inch high. These cavities are used by the workers for temporarily storing the collected grass. It is maintained that these temporary storerooms are used to exclude the gases, which are liberated during the fermentation of the collected green grass, from the nest where they might be injurious to the young larvae. From these pockets some passages, as thick as a man's small finger, run parallel to the surface, while others descend progressively by a series of steps into the soil where they become larger and in due course connect up with the hives, which constitute the actual nest of the colony.

In the neighbourhood of the hives, remarkable mazes of interconnected flat shelves are found, in all of which supplies of mown grass are stored. These shelves are directly or indirectly connected with the hives of the nest and also with the pockets just below the harvesting holes. From the hives other passages run by a series of steps to the surface, through which the large quantities of soil, which are excavated in the making of the hives and passages, are dumped on to the ground surface in the form of small mounds of sand grains.

A Colony Dug Up.

Recently a strong colony of harvesters at the Frankenwald Experiment Station, near Johannesburg, was investigated. Only 20 yards of an infested area of approximately 100 square yards was opened up. In this small area, no less than 9 nest hives, which were inter connected by a maze of narrow passages, were exposed. All these hives were consequently parts of one colony. Four of them were bigger than the others, contained large quantities of half-eaten grass, and were densely populated by termites in all stages of development, from small newly-hatched larvae to full-grown soldiers and workers. No trace of the queen could be found, although possibly she might have been present in one of these hives just before it was opened. She does not show the marked distension typical of the queens of so many other species of termites, is exceptionally active, and leaves the nest at the least sign of danger. The remaining hives were smaller, and contained only grass, workers, and soldiers, and larvae in a fairly advanced stage of development. For this reason it is presumed that these 5 hives were not true nests, but storerooms for the quantities of grass collected.

Each hive consists of a dome-shaped cavity, 1 to 2 feet in diameter, situated approximately 1 to 4 feet below the ground surface. One case is on record of a hive which was found at a depth of 20 feet. In the cavity of the hive there are hundreds of close-set, inter connected shelves consisting of a black, brittle material of the thickness of paper. In these shelves large quantities of grass are stored by the termites. Only when such a colony is dug up can a conception be formed of the quantity of grass harvested by the termites and carried underground. Each of the hundreds of pockets, all the hives and the large number of shelves in their vicinity, are closely packed with grass. Only 9 hives were dug up at Frankenwald, but possibly more than 30 would have been exposed if the whole infested area of 100 square yards had been uncovered. With this large supply of grass stored underground, and the fresh supplies which are constantly introduced to supplement the grass consumed by the ever increasing numbers of individuals in the colony, it is clear why the presence of a harvester colony in the veld is usually marked by bare, grassless patches.

Damage to Grazing.

This brings us to the part played by harvesters in the destruction he grazing, i.e., their influence on the carrying capacity of the l.

The harvester termite collects grass throughout the year, but has been shown to be most active during the dry months of the year. e harvesting of grass will, therefore, not be severe in the Transvaal l the Orange Free State during summer, except in seasons of nmer drought, as high rainfall is a factor probably restricting face activities. During seasons of normal rainfall when plant wth is good, the harvester will not appreciably affect the carrying

capacity of pastures. Their presence is hardly noticeable in such years. But what happens in years of summer drought? Owing to the lack of rain, the dry grass, which is soon removed by stock and termites, is not replaced by new growth. There is no decrease in the number of termites in the harvester colonies, and the whole population has still to be fed. If the grass in the vicinity of the nest has been exhausted, the termites are compelled to extend their harvesting passages further and further afield. The limited quantities of grass left ungrazed or surviving the drought are destroyed by the termites. The fungus-grower termite species such as *Termes natalensis* and *Termes badius* are well represented in the Transvaal as well as the Orange Free State, and in the absence of wood, these species are

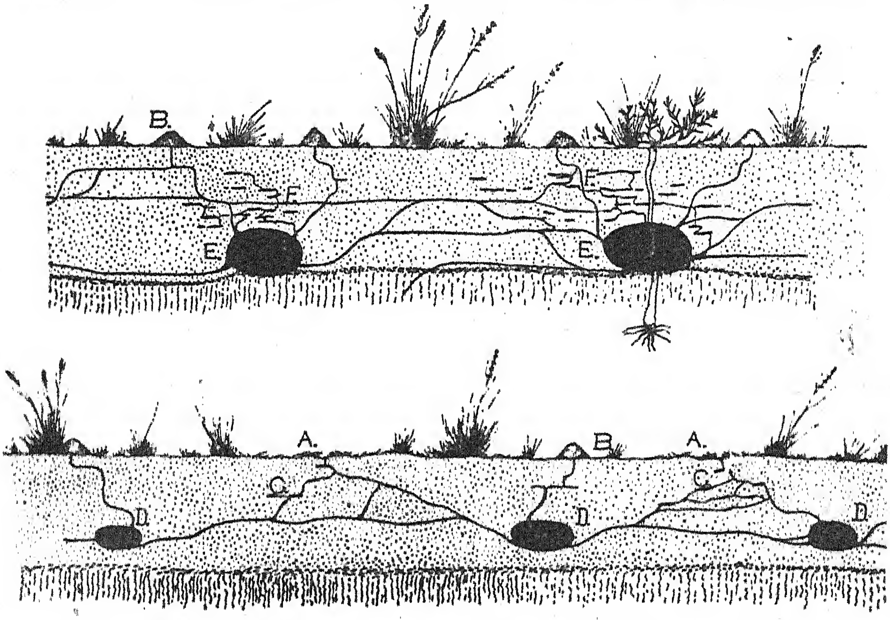

Fig. 4.—Diagram illustrating organization of part of the harvester colony excavated at Frankelwald. Note: The left-hand portion of the upper sketch is a continuation of the right-hand portion of the lower sketch.

A.—Harvesting holes. B.—Soil dumps. C.—Harvesting pockets. D.—Small Harvesting hives. E.—True nest hives. F.—Shelving for grass storage.

forced to live mainly on dry grass. As the grass is mown down by the harvesters, the fungus-growers cover the stubble with clay, under cover of which the plants are destroyed down to the roots. In this way the veld is practically completely denuded of the vegetation which is so essential for keeping stock alive during periods of drought.

Ground denuded of vegetation in this way, recovers very slowly when once the rains come. Usually chiefly inferior grasses, such as "steekgras", which appear early in the grass succession, are to be found in such localities.

In the choice of the locality for their nest, the harvesters prefer dry, well-drained areas such as hill slopes. Consider for a moment the result of these bare patches of ground, brought about by fungus-growers and harvesters on the slopes. When the rains fall, this lack of vegetal covering could easily be one of the initial causes of soil erosion.

Control Methods.

Coming to the methods of combating the harvester termites, we have already seen that a colony consists of numerous nest hives and a maze of narrow passages, cavities and shelves. The queen is very active and may be present in any one of the hives. At the least sign of danger, she forsakes the hive, which is very difficult to find and may be located at anything from 2 to 20 feet below the surface. In these circumstances it can easily be seen that the common method of digging up and destroying the queen is most unpractical. Further, as the result of the long, narrow, branching passages, methods such as fumigating the colony are equally unserviceable. The only known practical method of control is the use of bait. This method was recently tested out with considerable success in Pretoria.

Cut quantities of grass, preferably hard veld grasses with narrow leaves, into small pieces about half an inch long. These pieces of grass are then soaked for a few minutes in a solution of 1 lb. sodium arsenite, 8 lb. brown sugar and 8 gallons of water. The grass is then removed from the solution. The bait may be used in a moist condition, but should preferably be dried and stored in bags, so that a good supply is available whenever required. The dry bait is also less unpleasant to use.

At every opportunity when harvesting activities are observed, the bait should be broadcast on the affected spots after the manner of sowing lucerne seed. A native on horseback can cover the farm daily and scatter a few handfuls of bait wherever activities are seen. The termites will eagerly carry the poisonous bait into the nest and in time it is consumed by the inmates of the nest. The process of destruction is slow and results cannot be expected immediately. Bait should be regularly strewn over a period of about two months or longer. Activity will gradually diminish and will eventually cease altogether if baiting is carried out regularly and thoroughly.

Each farmer should decide for himself whether the carrying capacity of his veld, especially during periods of drought, is reduced by harvesters. On close inspection he will find that the little trouble and expense involved in connection with the control of the species is being amply rewarded.

Reprints.

(Obtainable from the Division of Chemical Services, Pretoria.)

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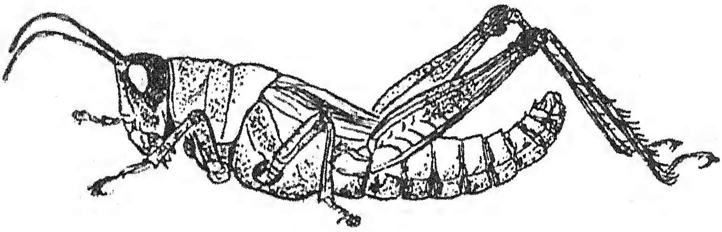
The Elegant Grasshopper.

Dr. Bernard Smit, Senior Entomologist, Pretoria.

THE Division of Entomology is receiving many requests from farmers and gardeners for information on the control of the elegant grasshopper, which is often called the " stinksprinkaan ".

This insect does a great deal of damage in lands, gardens and orchards by its attack on a great variety of plants. It hops about in a sluggish way and is never able to fly, but it feeds on green leaves wherever it finds them and often climbs into fruit trees where it



The Elegant Locust or Stinksprinkaan *Zonocerus elegans*.

devours the green fruits. Sometimes in peach trees it eats away half-grown peaches until there is nothing left but the pip. In vegetable gardens it often destroys crops of tomatoes, pumpkins, beans, etc., and in nurseries has sometimes attacked young apple trees.

Habits and Peculiarities.

This species of locust does not form swarms, except when very young, but it is wide-spread throughout South Africa and in certain seasons becomes very abundant. It is called the " elegant " locust or grasshopper, because of its beautiful bright colouring of green, yellow and pink, but, however elegant it may be, it throws out a very evil-smelling liquid when caught and that is why it is called " stinksprinkaan ". The female locust lays her eggs in the ground during the autumn and these hatch the following spring into small black hoppers with yellow stripes and markings on their bodies.

Just after hatching, the hoppers have the typical gregarious habit of locusts and mass together into small swarms on low bushes in the veld. They are particularly fond of the common milk-weed, *Asclepias*, and often appear as black masses at the base of these plants. This habit of forming swarms when young is important from the control point of view, for it gives us an opportunity of destroying them with poison at this stage.

Moreover, we find that the young hoppers are less resistant to poison than the full-grown elegant grasshoppers are. The older hoppers, especially when they become adult, seem to be able to stand a good deal of arsenic, and, as one farmer put it: " The only way is to chop their heads off ". Why this is so, is not fully understood. It may be because they eat more slowly than the swarm locusts and also because they seem to have a thicker integument. They do not, in any case, take to locust bait as well as the brown or the red locust, but prefer succulent green food. If bait is used, Fuller recommends that a fairly large amount of sugar should be added.

Control Measures.

There is only one generation of these locusts a year, but if we miss our opportunity in destroying them, they may, nevertheless, become a serious pest. The following control measures are recommended:—

(1) Watch for eggs deposits in the autumn, and, if possible, detroy these during the winter by ploughing or cultivation of the soil.

(2) In the spring watch for the hatching of the eggs and the swarms of the young hoppers, which then appear. To destroy these, spray them in the veld with locust poison, using a solution of *arsenite of soda* made by dissolving 3 tablespoonfuls of the powder in 4 gallons of water. In this case the poison kills by contact and must be sprayed on to the insects themselves to wet them thoroughly. Be careful not to poison stock.

In long, dry grass the hoppers can sometimes be burned effectively.

Where stock is running, use a spray made by emulsifying old motor oil with water as follows:—Cut up half a pound of soap into small pieces and dissolve in half a gallon of boiling water. Into this, while hot, pour slowly and stir half a gallon of old crankcase oil and beat up well to form a thick, creamy emulsion. To this, add two gallons of cold water and stir thoroughly. If this is sprayed on the hoppers, it will kill them within about half an hour.

(3) When the hoppers have scattered, but before they are fully grown, a bait can sometimes be used. If ordinary locust bran bait is used, it should first be mixed with sugar, using 6 lb. of sugar to 20 lb. of the poisoned bran, and then wetted with 1½ gallons of water. A green bait, as used for cutworms, is usually more effective. To make this, dissolve 1 lb. of arsenite of soda and 8 lb. of sugar in 8 gallons of water. Chop up succulent green stuff, such as beet-tops, and wet this with the poison solution, stirring well to get an even mixture. The bait should be spread on bare ground where the hoppers are abundant.

In some cases, spraying plants that are being attacked will help matters, but this is not very effective. The best spray to use is a mixture of *arsenate of lead* in water, using 3 oz. to 4 gallons. On stone-fruit trees, such as peaches, apricots and plums and also on citrus, arsenate of lead should not be used.

(4) Finally, when the locusts have reached the adult stage at the end of summer, mechanical methods of control must be resorted to, and although these seem laborious, they are often very effective, particuarly in small gardens. Collecting by hand or with improvised butterfly nets, made of orange pockets, in the early morning, will reduce the numbers very quickly and the locusts should be thrown into tins with a little paraffin to kill them. Swatting the insects with a bundle of stiff wires is very effective when they are on the ground. In fruit trees, many farmers just snip them in two with sheep-shears; in lands, rolling with a Cambridge land roller is sometimes effective, but much depends on the condition of the soil.

In controlling this pest, the best time to destroy the locusts is just after they hatch from the eggs and to do this a careful watch should be kept for young swarms in the spring.

Tanning of Hides and Skins.

Dr. S. G. Shuttleworth, Director, Research Institute for the Leather Industry, Rhodes University College, Grahamstown, and Mr. S. A. Degenaar, Extension Officer, Griquatown.

SINCE time immemorial, the skins of animals have been used for protecting the human body against extremes of heat and cold. These skins consist, however, of an albuminoid substance (Collagen), which is very succeptible to attacks by bacteria which impair their durability. From the earliest days attempts were, therefore, made to protect the skins against this type of decay, and of the various methods evolved for this purpose tanning has been found to be the most effective.

Properties of Leather.

Leather is a useful product derived from the skins of animals, protected against natural decay by the action of tannic acids and other chemical substances, and made soft and flexible by fats and oils.

Commercial leather is manufactured from the skins of sheep (particularly bastard sheep) and goats, and the hides of cattle. Leather for uppers or vamps is prepared from the skins of sheep, goats, calves and wild buck, while sole-leather is manufactured from the hides of large animals. Generally speaking, the skins of young animals are the best. The skins of older animals become rough and are usually damaged to a greater extent by wire, bushes, etc. Uppers made of sheepskin are lighter than those of calfskin and are generally used for upholstery. The vamp leather furnished by one sheepskin usually covers an area of 6 to 10 square feet. Calf leather has a fine grain and is soft. It usually gives a piece of vamp 10 to 14 square feet in extent. Goat skins yield from 7 to 10 square feet and large oxhides give from 40 to 50 square feet.

Skins of the same class differ largely in size, thickness and texture. The same skin differs in different parts. The skin is more elastic when stretched breadthwise than lengthwise—a fact which should borne in mind, particularly in the making of gloves. It should, however, be clearly understood that the manufacture of leather is a very complicated industrial process, requiring a high degree of training and skill. The processes are generally carried out with very expensive machinery, and without the necessary machinery or training one cannot hope to produce the same type of leather as is to-day sold commercially. The methods which are described here are suitable under farm conditions, when machinery is not available.

The Preparations and the Tanning Process.

The Tanning Vat.—Various types of vats can be used. Vats made of skin or wood are in most general use, although vats are also constructed specially for this purpose of stone, cement bricks or concrete. The vat may be either above or below the surface of the soil, but must, as far as possible, be kept under a tree or in some other shady spot. There should also be facilities for protecting it against rain. A convenient size is seven feet long, three feet wide and from two to three feet deep. A smaller vat may be used for tanning sheep and goat skins. Iron tanks must not be used.

The selection of the skin.—Do not purchase just any skin without ascertaining how it has been treated. An inferior skin may cause the entire process to fail. Make as little use of the knife as possible in

flaying. Immediately after flaying, the skin should be washed thoroughly in clean water to remove any blood, which may still be present. It is then opened out and thoroughly sprinkled with fine salt which is as free as possible from alum, calcium sulphate, etc. The skin is then folded up for about one to one and a half days to allow it to become thoroughly impregnated with the salt solution, after which it is opened out in a well ventilated spot and left to dry in the shade. Care should be taken not to stretch it. As soon as it is wind-dry it is folded up with the hairy side on the inside and stored until it is ready for tanning. The skin should never be folded up with the fleshy side on the inside or hung over a wire, since this will injure the grain.

The soaking or moistening of the skins.—Immerse the skins in clean, soft water until they are thoroughly soaked. This usually takes from one to three days according to the thickness of the skin. If the vat is used for soaking, clean water must be added every day. When quite soft, the skins must be removed and washed thoroughly to remove all salt and dirt.

Removing the Hair and Tanning the Skins.

In the following process, use is made of vegetable substances (bark) for tanning sheep and goat skins.

After the skin has been thoroughly soaked it is thrown open with the hairy side downwards, and a soft dough, prepared from a mixture of equal parts of slaked lime, sodium sulphate (Glauber salts) and water is spread over the inner side. This mixture has a corrosive effect on the hand, and rubber gloves should, therefore, be used. The skin is then folded up with the side edges meeting in the centre. It is then again folded along the centre to a quarter of its original width, after which it is rolled up tightly. As soon as the hairs come off (four to six hours) the skins are opened out and drawn across a dome-shaped block with the fleshy side facing downwards. The hairs are removed by means of a bent hoop or "Scudding" knife, i.e., a bent knife with a handle at each end. The skin is then immersed for 48 hours in a solution containing about 3 per cent. lime, and stirred at intervals. It is then removed and drawn across the block with the fleshy side upwards and the fat and flesh are removed. After this the skin is washed in running water for three hours and then placed in a solution containing 5 per cent. boric acid or in vinegar. Agitate for two to three hours. By that time all the lime should have been removed and the skin should be fairly acid. (Test any cut edge with a phenolphthalein indicator.)

The skin is now ready for tanning. It is placed in a vat containing a 2½ per cent. solution of wattle bark extract. This extract is first dissolved in hot water and then left to cool. The skin is shaken from time to time and the above quantity of extract is added in the form of a concentrated liquid until the skin has been thoroughly impregnated and tanned. The tanned surface is then thoroughly washed and the skin is thrown open to dry. While it is drying, it should occasionally be rubbed with a paste consisting of thoroughly mixed neatsfoot oil and soap. The dry leather is softened by working it across the steel blade of a spade planted upside down. If there is not sufficient oil in the skin to give the desired softness, neatsfoot oil should be rubbed in. Finally the skin is rubbed down on the inside with sandpaper to obtain the desired surface. School-bags may be made from the leather by sewing the seams on the wrong side of the leather and then inverting the bag so that the rough seams

are on the inside and the neat grain side of the leather on the outside.

Tanning of Hides for Harnesses, Saddles, Sole Leather, etc.

Thoroughly soak the hide and immerse it in a solution consisting of 5 per cent. slaked lime and 1 per cent. sodium sulphide. Shake every now and again. After four days the hair should come off easily. Remove the hair as described above, turn the skin over and remove the fat and flesh. Wash the hide for three hours in running water and place in a solution containing 5 per cent. boric acid or in vinegar. Stir for three to four hours, by which time all the lime should have been removed and the hide should be fairly well impregnated with acid. (Test any cut edge of the hide with the phenolphthalein indicator.)

The hide is now ready for tanning and is hung over a pole in a vat containing a solution of ½ per cent. wattle bark extract. (The extract is prepared in hot water and thoroughly cooled.) The hide is moved in the solution every now and then and is removed every day while the liquid is made more concentrated by the addition of bark extract, until the tanning liquor contains about 6 per cent. of bark extract. It is more practical, however, to have a series of vats arranged according to the strength of the liquid and to transfer the hides daily from one vat to another.

Leather intended for harness-making must be removed from the liquid as soon as it is thoroughly tanned, which can be ascertained by making an incision near the edge of the hide. The process usually takes from one to two weeks, depending on the thickness of the hide. The surface of the tanned hide is then washed, after which it is stretched open and left to dry. Every now and again both sides of the hide should be smeared with a paste consisting of soap and neatsfoot oil, or some sulphonated neatsfoot oil. The dry leather is softened by working it as described above, and if it is too dry, raw neatsfoot oil may be used. The leather is then ready to be cut up for harness-making. Hides intended for saddles must be kept in the extract for a fortnight longer in order to make the leather firmer; only two applications of oil are made before the hides are dried. A firm leather is required in order to enable a saddle to retain its shape. For sole-leather, the hides must be kept in the solution for a month and only one application of oil is required before drying. No softening of sole-leather is necessary.

The following is a method in fairly general use among farmers:—

Removing the hair from the skin.—The skins are thoroughly soaked and the following procedure is adopted for removing the hair. Pour about 20 gallons of water into a vat, and add half a bucket of slaked lime. Immerse the skins, with the hairy side up, in the lime water. Stir the solution a few times every day and remove the skins on the third day. Add further half bucket of lime to the solution to strengthen it and replace the skins. If necessary, this process may be repeated after three days. As soon as the hair comes off easily, the hair, flesh and fat are separated from the skin as described in the previous processes. The skins are then replaced in the lime water (large heavy skins are left there from 10 to 12 days and small skins from eight to ten days). After removal from the lime water the skins are placed in clean water for one and a half to two days, during which time they must be washed and rinsed three times a day to prevent them from rotting. In the meantime the vat should be thoroughly cleaned, and filled with clean water to which has been added one to two buckets of bran. When the bran has risen, the

skins should be packed in the vat. The skins should be moved frequently and rearranged as often as possible. After one and a half to two days, the skins may be removed, care being taken to prevent rotting. If bran is unobtainable, the skins may be immersed in clean water for three to four days to freshen (the skins usually rise to the top). After removal from the bran, the skins are washed thoroughly and are then ready for tanning.

Bark-tanning of Skins.

For the tanning of sole-leather and uppers by means of bark, the following procedure should be carried out:—

Pour 40 gallons of water into the vat. Dissolve the following in a small quantity of hot water: 3 lb. saltpetre, 3 lb. alum and 4 lb. Glauber salts.

Add this solution to the 40 gallons of water. Add fine bark until the solution is as strong as possible. Then pack the skins in the vat. On the first day the skins must be agitated every hour and removed several times. Subsequently the solution is stirred a few times daily, the skins being removed every two to three days. The solution may be strengthened by the addition of more bark. Heavy oxhides should be completely tanned within 15 to 20 days, while sheep and goat skins require seven to eight days. Test by cutting the skin near the thickest edge. If thoroughly tanned the skins are removed, thoroughly rinsed in clean water and then hung up in a cool spot to be wind-dried.

Take one gallon of hot water and the following: 1 lb. ordinary soft fat, ½ lb. raw linseed oil, ¼ lb. neatsfoot oil.

Dissolve 4 oz. soap in a small quantity of hot water, add to the above solution and boil for about 10 minutes. Apply this mixture to both sides of the wind-dried skins; roll the skins up tightly for one to two days and then soften as described above. Sole leather is not softened.

Tanning Harness Leather and Thongs.

When the skins have been removed from the lime water and the bran, they should be immersed in the following mixture for half an hour:—25 gallons hot water; 2 lb. alum; 10 lb. salt; 1 lb. sulphuric acid; 2 lb. bran; 2 oz. dissolved sulphur.

Dissolve all the solids in the hot water. Then add the sulphuric acid slowly. (Never add water to sulphuric acid.) Remove the skins after half an hour and add the following to the mixture:—

1 oz. crushed copper sulphate (blue vitriol); 4 lb. salt; 2 oz. alum.

First dissolve the salts in some hot water before adding to the mixtures. Replace the skins and stir often every day. For oxhides, seven to eight days will suffice. In the case of sheep and goat skins intended for thongs, four to five days are required.

If it is desired to dye the skins for harness-making purposes, they may be placed in clean bark solution. Stir well and leave until the desired colour is obtained. When the skins have been tanned, the same paste may be applied as for sole leather. Fold up and work until soft. Thongs cut from a skin prepared in this way are white, soft, and strong and have no smell. The skin of a blackhead Persian gives the best thong. It is desirable to store this type of tanned skin in an air-tight bottle or canned-fruit bottle.

 [*Continued on page 364.*

The Draught Horse.

II. Feeds and Feeding.

Dr. L. L. Roux and H. J. v. d. Merwe, Grootfontein College of Agriculture, Middelburg, C.P.

THE success of any horse-breeding enterprise will be determined by the suitability of the climate, the quantity and quality of the natural pasture, and the possibility of producing adequate quantities of feed economically.

Feed is certainly the most important factor to be taken into account when considering the maintenance costs of horses. In the

Fig. 1.—Preparation of seed-bed, College of Agriculture, Cedara.

case of a horse-stud breeding enterprise, the sale of stock is the main source of return. When horses are used as a means of farm draught, the problem of the relative costs of the various means of farm draught must be considered. Some studies have been made upon the comparative costs and relative efficiencies of the ox, horse, and tractor, but unfortunately, at the present stage, these do not permit of more than very general advice upon the suitability of any one of the means of draught for different stages of development of farming systems in various parts of the country.

Although the maintenance costs of horses and mules are greater than those of oxen, horses have been proved to be more efficient. Moreover, conditions may be such that grazing is not available for oxen or that the price of grazing land may be so high as to render the use of oxen relatively uneconomical. The many conveniences connected with a tractor are, to an extent, and often to a very appreciable extent, offset by the high operating and maintenance costs

and the relatively short period of usefulness. The ox may be fattened and sold after four or five years of use, while the draught mare is frequently still useful for work at 20 years and many produce excellent foals at that age.

In general, it may be said that the coastal areas of Natal and immediately south of Natal, the low and middle veld areas of the Transvaal, and the extremely barren parts of Bechuanaland are *unsuitable* for horsebreeding. Good sheep areas are generally good horsebreeding areas, the vegetation is sweet, nutritious and it has good bone-forming qualities.

The following are considered the best horse-breeding districts, viz.: Colesberg, Middelburg (Cape), Woodhouse (vicinity of Dordrecht), Robertson, and Malmesburg (vicinity of Darling).

With horses, as in the case of other classes of live-stock, the stockman or groom should be well acquainted with the feed requirements of the animals under his charge.

The first object should be to make the greatest possible use of the natural pasture for as long a period of the year as possible. The next consideration is the supply of supplements in the form of established pastures and other feeds which can be most economically grown or produced on the property. It will always be necessary to buy some feeds, especially certain by-products which have high nutritive values.

The Nature and Properties of Feeds.

For the sake of those who are unacquainted with the nature and properties of feeds, the following general outline is given in order to stress the existence of important physical and chemical, and, consequently, nutritional differences of feeds.

(1) *Roughages.*—These are feeds high in fibre content (cellulose and related compounds) and are, therefore, of relatively low digestibility when compared with feeds such as the grains. They are divided into two classes, viz.:—

(*a*) Roughages high in carbohydrate content (starches and sugars), e.g., pasture grasses, grass hays, stovers, maize, sorghum and grass silages, root crops, etc., and

(*b*) roughages rich in proteins (amino acids), e.g., leguminous hays: lucerne, cowpea, and soyabean.

(2) *Concentrates.*—These feeds are comparatively low in fibre content and of relatively highly digestibility compared with the roughages; e.g., seeds, cereals and their by-products; and abattoir, fish and whale by-products. Concentrates may be either *rich* or *low* in protein, hence they are referred to as nitrogenous and non-nitrogenous concentrates respectively.

(*a*) Concentrates rich in protein (nitrogenous), are most valuable in animal feeding as they supply the nutrient of the greatest importance for growth and reproduction; e.g., peanut oil-cake, linseed oil-meal, cotton seed oil-cake, meatmeal, bloodmeal and fishmeal.

(*b*) Concentrates low in protein (non-nitrogenous): are maize, kaffir-corn, cereal grains and by-products of these grains.

(3) *Minerals and Vitamins.*—These substances are essential for animal growth, development, and reproduction. The skeleton of the body is composed chiefly of calcium and phosphorus, iron is a vital part of the blood, while sodium and chlorine are intimately connected with the maintenance of the body cells, and they form an important constituent of blood. Other minerals such as iodine, iron,

copper, sulphur, etc., are essential, although they are required by the body in minute quantities.

The substances known as vitamins, of which, up to the present, six have been identified, play a varied and vital part in animal growth and reproduction. For instance, lack of vitamin A results in diseases of the skin, eyes, reproductive organs, etc.; lack of vitamin C in nervous diseases; lack of vitamin D in abnormalities of bone formation, etc. However, it may be safely said that, if a

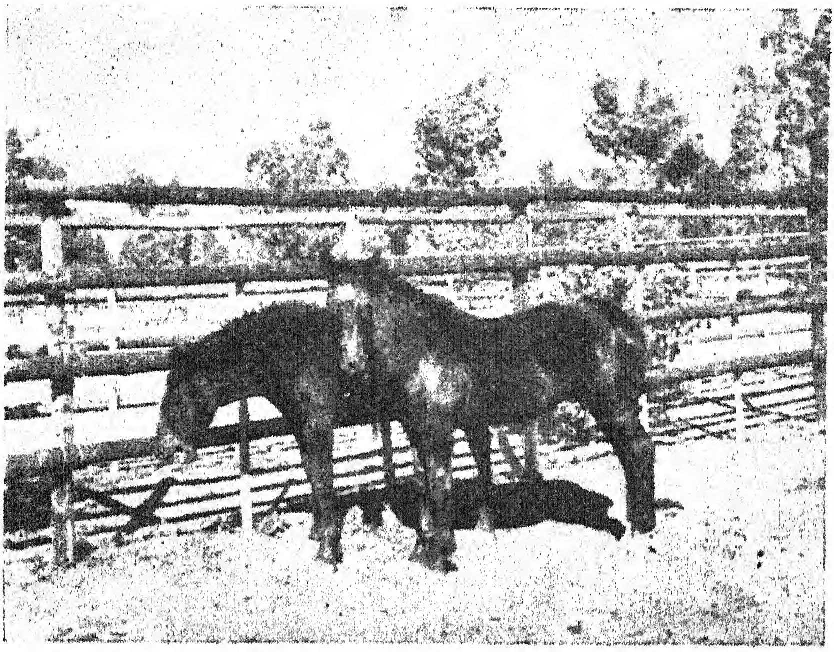


FIG. 2.—Percheron colts at Grootfontein College of Agriculture.

variety of good foods is fed and horses are given ample opportunity to graze out on pasture, there will be little danger of a deficiency of anyone of these vitamins.

The facts of greatest importance in this country are inadequate feed (total requirements) during the winter months and during prolonged droughts, and particularly the insufficiency of protein, calcium and phosphorus in the unpalatable, indigestible dry grass.

Lack of protein, calcium, and phosphorus inhibits growth and development, postpones maturity, reduces fertility, affects the activity of all glands, often results in malformations, and greatly reduces the general stamina and disease-resisting powers of the animal.

In the case of the draught horse, rapid growth and normal development are essential if size, strong bone and muscular power are to be achieved. The object of introducing draught horses into a farming system would not be accomplished if improper feeding does not permit of satisfactory development. It is, therefore, necessary for the person in charge to observe the results of his management carefully in order to permit him to recognize symptoms of incorrect feeding and to determine which supplements are required.

Hay and Other Dry Roughages.

Grass hays, including teff hay are standard hays for horses over a large area of the Union. They vary considerably in nutritive value, but all of them are carbonaceous and they are, therefore, best fed in conjunction with legume hays or with concentrates of high-protein value and with minerals, especially calcium and phosphorus. On account of their feed value they are good for work horses, but less valuable for foals and brood mares. It is important that they should be cut at an early stage and well cured, and should be free of moulds.

Cereal hays are used extensively in cereal-producing areas. Oat hay is the most valuable of these for horses. When specially cut for horses, the grain should not be allowed to become too mature as the quality of the hay will be reduced. They may be fed alone, but the value of the ration is considerably improved by feeding them in conjunction with any legume hay. However, if fed alone, they should be supplemented by protein-rich feeds, such as peanut meal and linseed meal.

Sudan and Johnson grass hays are relished by horses and are safe feeds. They are best fed in conjunction with legume hays, especially in the case of breeding stock and young stock. Millet hay is not a safe feed for mares in foal. The crop should be cut before it is mature.

Straw and stover are bulky and non-nutritious feeds; they are high in fibre and low in protein and mineral content. Horses should not be wintered on these feeds, as they are too low in protein, calcium and phosphorus to form the sole feed even of idle horses. Oat straw is preferable and barley and wheat straw are next in choice, while rye straw is not at all desirable.

These roughages are often used to advantage with leguminous hays, as the former make up some of the necessary bulk. When fed in conjunction with other carbonaceous hays, such as grass hays, protein-rich concentrates should be fed. Straw and clover should be fed in the cut or shredded state.

Lucerne hay is a very satisfactory and palatable feed for horses and especially for young stock, since, being rich in protein and essential minerals, it has good bone- and muscle-building qualities. It also has a laxative effect and, as horses are inclined to eat too much at a time, it is necessary to restrict their daily consumption to about 1 lb. of hay for approximately each 100 lb. of live weight.

For show horses it is generally recommended to feed lucerne only to the extent of one-third of the roughage ration. For other horses lucerne may make up half to two-thirds of the roughage ration. Carbonaceous hays (grass hays, straw, etc.), should be used to make up the remainder of the roughage ration.

Lucerne hay is best fed in conjunction with non-nitrogenous concentrates, such as the cereal grains, maize, etc.

The first cutting of lucerne hay is considered best for horses, as there is then generally a smaller percentage of leaves to stems. It is considered by some that lucerne hay with a high percentage of leaves to stems tends to cause scouring. The lucerne is best cut when it is fairly mature. Dusty lucerne hay should be sprinkled before it is fed. It is dangerous to feed mouldy lucerne hay to horses.

Legume Hays.—Cowpea, soybean and velvet-bean hays are all legume hays high in protein and very suitable for use with rations of high carbohydrate content, such as maize and the cereal grains. They can also be used to advantage with carbonaceous hays, such as

grass hays, straws, etc. Soybean hay is frequently used in other countries to fatten horses for the market. Vetch hay, although not often used for horses in certain countries, is rich in protein and it may make up half the roughage ration. Oat and vetch hays make good combinations.

In general it may be said that the chopping up of or shredding of hays has not been found to be economical unless the material is of poor quality when consumption would be improved and waste lessened, as in the case of soybean straw. Poor-quality hays may be sprinkled with molasses to improve their palatibility.

Succulent feeds have a cooling and laxative effect upon the digestive system and they stimulate the appetite. Good pasture is the best succulent feed, and it is particularly valuable for mares and foals. Work horses, when on pasture, are inclined to sweat more at work then when stabled during out-of-work periods. Whenever possible the pasturing of horses should be continuous and not intermittent.

In a climate such as that of the Union, horses should spend as much as possible of the day and night outside on pastures. This does not mean that they need not be groomed and given supplementary feed when high-level feeding is necessary. The owner should use his discretion as to where and when shade and shelter should be provided. This practice will lead to better health, certainly better feet, and labour costs will be reduced. Such management can be best achieved by having suitable pastures near the stables and yards.

Pastures vary greatly in value, depending upon the grasses present and the treatment the pastures have received. In many parts of this country, natural pastures have a high feeding value for only a short period, but established pastures may be successful in any area where the rainfall is adequate or where irrigation is possible.

Idle horses on good summer pastures may need no supplementary feed, but such pastures (natural or established) are unlikely to be adequate during the winter months, even for idle horses. It is possible that the addition of legume hay, 8 to 10 lb. per day, may keep idle horses in good condition. Horses at work, mares and foals, and colts on pasture require supplementary feeding.

Most of the forage crops mentioned above can be cut green and fed to horses. Care should be taken, however, to introduce such feeds gradually and to feed them in a fresh state.

Miscellaneous Feeds.

Carrots, parsnips, and beets are liked by horses, and their greatest use is as an aid in digestion. When these feeds are fed, other laxative feeds should be withheld. Roots are best fed in the chopped state.

Potatoes are well suited as a horse feed. Work horses may be fed as much as 12 to 15 lb. per day. They should be chopped to reduce the danger of choking. Potato sprouts are injurious to horses.

Pumpkins are fed to horses mainly to improve digestion. The amount fed daily should be limited to about 8 lb., and other feeds higher in nutrients should be fed to balance the ration. Pumpkin seeds have a laxative effect. Frosted pumpkins should not be fed.

Silage, if fed, should be introduced gradually into the ration. It should not be regarded as one of the principal roughages for horses, and the amount fed daily should be about 10 lb. Its greatest

use is as an appetizer and a tonic. There is no objection to the feeding of silage to idle horses; it should be used in limited quantities for brood mares and growing colts. Maize silage is the only silage that has found favour with most horsemen. It is very dangerous to feed mouldy silage.

Peanut meal is often fed to horses. It is a safe feed, but, being very rich in protein, it should be fed in conjunction with non-nitrogenous concentrates, e.g., maize, or with non-leguminous hays, e.g., grass hays. The feed should be introduced gradually. Shelled peanuts are liable to become rancid and, therefore, cannot be stored.

Linseed meal is high in protein, it has laxative properties and is, therefore, ideal for feeding with such feeds as maize. Being an unpalatable feed, it should be well mixed with the other constituents of the ration. This feed is exceptional for producing a bloom in show horses. It can be fed at the rate of 1 lb. or less per day.

Soybeans, cowpeas, and velvet beans are high in protein content and they are, therefore, suitable for feeding in conjunction with a feed such as maize. These feeds should not make up more than one-third of the concentrate ration. As they are hard, they should be ground.

Bloodmeal and meatmeal are not favoured as horse feeds because they are unpalatable. They have a very high protein content and can be used to advantage with non-nitrogenous concentrates with which they can be fed at the rate of up to 1 lb. per head per day.

Oats is the most valuable concentrate feed for horses. Apart from its high nutritive value and high digestibility, it has most suitable physical properties in that it is bulky, so that there is less danger of digestive troubles than in the case of feeds such as maize, wheat or barley.

Should there be any danger of over-eating, oats may be mixed with some such feed as chaff. The use of wheaten bran with oats not only lessens the chances of choking in the case of greedy eaters, but also greatly improves the ration. Oats may be fed in the whole or rolled state; they should be rolled for very young animals.

Maize is generally given preference over oats in maize-producing areas. In such cases, over-feeding must be guarded against and suitable supplementation must be considered. Maize is a heavy, starchy concentrate. Horses generally require 15 per cent. less maize than oats in a well-balanced ration. When maize is fed to horses on veld or grass pastures or in conjunction with non-nitrogenous hays, a protein-rich supplement is necessary. Maize and legume hays give good results, but better results will be obtained if a mixture of grains (oats and maize) is fed. Maize is often fed on the cob to prevent too rapid eating. If maize is ground for horses, it should be cracked or ground coarsely. Very dry, hard and flinty maize may be soaked. Corn and cob meal can be fed. As there is a danger of the meal generating heat and of moulds forming during storage, it is best to grind the grain in the quantities required.

Barley is fed to horses in areas where the crop is grown. It should be crushed or rolled, but not finely ground, as it is likely to form a pasty mass with the saliva of the mouth. If barley cannot be ground, it may be soaked. Rolled barley is suitable for use as the major portion of the concentrate ration and it may be fed in conjunction with 15 per cent. wheaten bran or 25 per cent. ground oats.

Wheat is seldom fed to horses because of the high price. However, when fed, it should be crushed or rolled. If this is not possible, the grain should be soaked. Wheat should not be fed as the only grain, but mixed with bulky concentrates such as oats or wheaten bran. The nutritive value of the ration will be improved greatly if wheat is fed in conjunction with a legume hay.

Wheaten bran is one of the most favourite feeds for horses, chiefly because it is safe to feed, is bulky and it has a laxative effect. It is an essential part of the ration of brood mares, foals, stallions, and horses that are ailing. Wheaten bran is higher in protein than are oats and maize. It should not be fed alone, but in conjunction with other feeds, such as oats, maize, or barley. It is deficient in lime, hence it should be fed with legume hays, or, alternatively, adequate quantities of lime-containing licks should be provided.

Rye should be ground coarsely or rolled for horses. Being unpalatable and likely to cause colic, it is not a popular feed for horses. In the circumstances, it is best to limit the amount of rye feed to one-third of the concentrate mixture which may include either ground maize or bran or oats.

Sorghums are small, hard grains which should be rolled for horses. Their feed value compares favourably with that of the other grains, but owing to their constipating tendency, they should be fed in conjunction with a laxative feed such as wheaten bran.

Cane-molasses is high in carbohydrates and should, therefore, be fed in conjunction with a feed which is high in protein. It should be diluted with 2 parts of water and sprinkled over the roughage or concentrate. Molasses is an excellent appetizer, but it is neither laxative nor binding. Generally, molasses is an economical feed only in the cane-producing areas. It may be fed at the rate of about 5 lb. per day.

Minerals.

Detailed analyses of numerous samples of pasture collected monthly over a period of years from different parts of the Union, have revealed the extent of the mineral deficiencies of the veld, and it is now possible to prescribe with greater certainty the supplementary mineral requirements of live-stock in the different parts of the country.

The following information upon the mineral requirements of horses has been supplied by Dr. A. I. Malan, Research Officer, Onderstepoort:—

"When horses are largely or entirely dependent upon the veld for their nutritional requirements, the mineral lacking in most cases is phosphorus and not calcium. It is best to allow horses on veld free access to the following lick:—

Di-calcium phosphate	2 parts by weight.
Calcium carbonate	2 parts by weight.
Salt	1 part by weight.

Salt is added to make the lick somewhat more attractive and to enable the control of consumption. Should horses consume more than 1½ oz. per head per day, the salt portion of the ration may be increased, and, if too little is taken, the quantity of salt should be reduced.

If the fine powdery condition of the lick appears to be affecting the consumption, it may be damped with water or diluted molasses.

When horses, and especially young horses, depend largely upon concentrates and roughages fed in the stable for their nutritional requirement, they are no doubt receiving adequate quantities of phosphorus but inadequate quantities of calcium. This is the case particularly when large quantities of concentrates are fed. In the circumstances, it is best to feed extra calcium, and it will be found that a satisfactory balance will be obtained by feeding 1 to 1½ oz. of calcium carbonate per head per day. Abundant supplies of legume hay would reduce the required amount of calcium carbonate to 1 oz., but there is no danger in giving the larger amount ".

Tanning of Hides and Skins:—

[Continued from page 350.

Making Useful Leather Articles.

Implements required.—Various implements can be used, but the following is a list of the most important which will be required at the start:—

1. A few awls of different thicknesses.
2. A pair of compasses which can be set to describe circles of varying sizes.
3. A good knife.
4. A pair of scissors.
5. A few punches of different sizes.
6. A clamp or saddler's clamp.
7. Some pitch or beeswax.
8. An overall.

The patterns for articles can be cut from models and thereupon placed on the skins which should be cut as economically as possible without undue waste.

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 | MAY 1943 | No. 249

CONTENTS

* Price Review for March, 1943.

SLAUGHTER CATTLE. Supplies increased from the middle of the month. The general quality, however, was not very attractive and prices were again somewhat lower than for February. Many good quality cattle, but with unfinished market condition, were offered, which must be ascribed to the scarcity of feedstuffs. Ordinary primes on the Johannesburg market declined from 60s. 11d. per 100 lb. estimated dressed weight *on the hoof* in February to 58s. 2d. in March. Good mediums from 55s. 8d. to 54s. 4d. and Compounds from 44s. 5d. to 43s. 1d. On the Durban market, No. 3 declined from 43s. 11d. per 100 lb. dressed weight *on the hook* to 41s. in March and undergrade from 34s. 6d. to 31s. 1d.

Slaughter Sheep. Very moderate supplies reached the markets and were mostly altogether inadequate for the sharp demand. Especially primes were in exceptional demand and prices rose above the previous month's level. Thus prime merinos on the Johannesburg market were 11·5d. per lb. estimated dressed weight in March as against 10·5d. in February, and prime crossbreds 9d. as against 8·2d. per lb. On the Cape Town market prime merinos rose from 10·1d. per lb. in February to 11·7d. in March and prime crossbreds from 10·1d. to 11·1d.

Pigs. On the Johannesburg market consignments baconers and porkers consisted mostly of second class quality. The demand for baconers, especially of prime quality, was bigger and prices as a result remained unchanged, viz., at 8·8d. per lb. liveweight, while porkers, for which the demand was weaker, declined, viz., primes from 7·4d. to 6·8d. per lb.

Grain.—Prices of kaffircorn declined fairly sharply and were 29s. 6d. f.o.r. producer's stations for K 1 and K 2 as against 34s. 2d. per bag the previous month. Dried beans were supplied very moderately, and rose in prices, e.g., speckled sugar beans on the

* All prices mentioned are average.

...ket from 30s. 1d. to 34s. 8d. and kaffirbeans from ...5d.

...airly large quantities Cape lucerne were on the markets, ... large percentage was of poor quality. Good quality was ...igher prices than the previous month, e.g., on the Johannes...arket Cape lucerne was 5s. 6d. per 100 lbs. as against 5s. the ...ous month, while on the Cape Town market good quality lucerne ... remained unchanged on the previous month's high level. The ...upply of teff grass gradually increased and experienced a sharp demand. On the Johannesburg market teff grass averaged 5s. 1d. per 100 lbs. as against 5s. the previous month.

Potatoes.—On most markets supplies declined somewhat and prices improved. Transvaal potatoes were predominant towards the end of the month and because these were of better quality prices also improved. Especially did National Mark potatoes maintain a stable level. On the Johannesburg market N.M. Grade 1 No. 2 and 3 averaged 13s. 1d. and 12s. 7d. per bag as against 11s. 8d. and 11s. 6d. per bag respectively for February.

Onions.—Supplies were exceptionally heavy at the beginning of the month but decreased to quite an extent towards the end of the month and, coupled with a good demand, prices rose fairly sharply in the last week, so that the average prices for March were somewhat better than for February. Transvaal onions on the Johannesburg market were 8s. 1d. per bag and Cape onions 11s. per bag.

Tomatoes.—Consignments Transvaal tomatoes appeared on the markets during the second half of the month and whereas prices were fairly high at the beginning of the month, they dropped to quite an extent towards the end of the month. On some markets, e.g., the Cape Town market, supplies, however, were smaller than in the previous month, and prices there rose. N.M. No. 1 tomatoes on the Johannesburg market were 3s. 11d. per tray and ordinary tomatoes 1s. 9d. per tray. On the Cape Town markets the average price was 1s. 10d. and on the Durban market 2s. 7d. per tray.

Vegetables.—Supplies of vegetables increased appreciably compared with the previous month. Supplies of pumpkins were again very heavy and prices on a low level. Supplies Transvaal green beans, squashes and vegetables marrows, gradually increased on the markets towards the end of the month and prices declined. Green peas were very scarce and dear everywhere at the beginning of the month, but also increased in quantities, especially during the last week. Carrots, cauliflower, lettuce and beetroot were scarce.

Fruit.—As regards deciduous fruits, apples, pears and grapes from the Western Province were predominant on all markets. Consignments, however, gradually diminished during the month and prices rose. Supplies of navel oranges from Transvaal increased during the month and so also consignments out of season Valencias. Prices were exceptionally high, especially at the beginning of the month. Pineapples were the only tropical fruit which were abundant and relatively cheap. Other kinds were scarce and dear. Consignments guavas were fairly large towards the end of the month.

Eggs.—Supplies further diminished and with a strong demand prices were on a higher level right through. New laid on the Johannesburg market were 2s. 9d. per dozen for March as against 2s. 3d. the previous month and fresh eggs 2s. 3d. as against 1s. 11d.

Index of Prices of Field Crops an. Products.

This index, as shown elsewhere, rose from 142 in Fe. 145 in March. No noteworthy decreases occurred in any groups of products. Several groups, however, show increases greater or lesser extent.

Hay rose from 130 to 142 in March as a result of a sharpe. demand for all feedstuffs. "Other Field Crops", i.e., potatoes, sweet potatoes, onions and dried beans, rose from 112 to 119 especially as a result of the improvement in prices of potatoes. Slaughter stock was 160 as against 156 in February and this increase was caused mainly as a result of the advance in the prices of slaughter sheep. The group "Poultry and Poultry Products" showed the sharpest increase, viz., from 186 in February to 246 in March, which is mainly the result of a further advance in prices of eggs during the month.

Dairy Products: Prices and Production.

Butterfat.—The Dairy Industry Control Board has decided to pay a subsidy of 3d. per lb. on all grades of butterfat delivered to creameries by producers from 1st May 1943, and a subsidy of 5d. per lb. as from 1st July 1943 until further notice.

The prices on which this subsidy will be paid are 1s. 6d., 1s. 4d. and 1s. 2d. per lb. for 1st, 2nd and 3rd grade respectively. This means that the producer will receive 1s. 9d. per lb. from 1st May and 1s. 11d. per lb. from 1st July for 1st grade butterfat. The corresponding receipts per lb. for 1st grade butterfat for the previous season were 1s. 8d. from 1st May 1942 and 1s. 10d. from 1st July 1942.

Cheese Milk.—On all cheese milk delivered by producers to cheese factories, the Board has decided to pay a subsidy of 2d. per gallon (or 5·5d. per lb. butterfat), from 1st May 1943 until further notice.

Producers will, therefore, from this date receive 11d. (9d. plus 2d. subsidy) per gallon cheese milk, while the corresponding receipts per gallon for the previous season were 10d. (8½d. plus 1½d. subsidy).

Milk for Condensing purposes.—The Board has also fixed the price for condensing purposes at 1s. per gallon or 2s. 9½d. per lb. butterfat from 1st May 1943. The fixed price for the summer months was 10d. per gallon or 2s. 4d. per lb. butterfat, viz., from 1st November 1942.

Union Factory Production of Butter and Cheese.

		Butter, lb.	*Cheese, lb.*
1941	December	3,144,000	1,262,000
1942	January	3,962,000	1,395,000
	February	4,517,000	1,603,000
	March	5,520,000	1,827,000
	December	5,243,000	1,987,000
1943	January	5,622,000	2,063,000
	February	4,701,000	1,980,000
	March (to 27th)	4,134,000	1,268,000

ove table it appears that for the months December, ebruary the production of butter as well as of cheese uring the present season than during the past season. ave drought of the previous summer, 1941-42, of course, production appreciably. In March of this year it appears, r, that the production of butter and cheese is much below of March the previous year. Especially the production of cheese s been decreasing exceptionally sharply since the middle of February. This decrease is mainly attributed to the general shortage of feedstuffs existing at present, especially of maize.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39 = 100.)

SEASON (1st July to 30th June).	Summer Cereals, (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops (d)	Pastoral Products (e)	Dairy Products (f)	Slaughter Stock. (g)	Poultry and Poultry Products (h)	Combined Index
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936-37..........	118	86	94	93	122	86	89	98	100
1937-38..........	89	106	112	118	98	112	105	107	101
1938-39..........	92	107	96	89	79	102	106	94	93
1939-40..........	86	108	77	93	116	105	106	89	104
1940-41..........	109	113	106	159	103	108	110	112	109
1941-42..........	121	132	145	205	101	131	134	163	124
1942—									
January.......	131	137	126	180	100	122	144	141	125
February......	132	138	125	168	101	130	140	147	125
March.........	126	140	140	175	101	130	134	168	125
April..........	126	139	151	170	102	130	129	175	125
May...........	158	139	188	181	102	154	132	203	136
June..........	159	139	207	186	101	154	140	218	13[illegible]
July...........	159	140	183	184	166	167	154	163	143
August........	159	139	181	175	115	167	155	130	140
September.....	159	139	182	191	115	167	176	133	145
October........	159	139	156	227	115	167	181	141	147
November.....	160	154	134	189	115	139	187	146	147
Desember......	160	154	123	137	115	139	178	158	144
1943—									
January.......	160	154	132	113	115	139	165	150	141
February......	163	154	130	112	115	139	156	186	142
March.........	161	154	142	119	115	139	160	216	145

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay

(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins

(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs
(h) Fowls, turkeys and eggs.

* Preliminary.

Average Prices of Potatoes and Onions on Markets.

Season (1st July to 30th June).	Potatoes (150 lb.). Johannesburg. Transvaal No. 1.	Johannesburg. Transvaal No. 2.	Johannesburg. N.M. Grade 1. No. 2.	Johannesburg. N.M. Grade 1. No. 3	Cape Town. Cape No 1.	Durban. Natal No. 1.	Onions (. Johannesburg. Transvaal.	Johannesburg. Cape.	Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940-41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December	11 6	9 6	14 1	13 3	12 2	15 6	9 3	10 11	11 9
1943—									
January	7 9	6 8	10 9	10 8	10 9	14 2	8 5	9 4	7 8
February	8 3	7 2	11 8	11 6	8 4	13 7	7 10	10 9	7 3
March	8 10	8 5	13 1	12 7	8 1	13 9	8 1	11 0	7 8

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

Season. (1st July to 30th June)	Eggs. Johannesburg. New Laid, per dozen.	Eggs. Johannesburg. Fresh, per dozen.	Eggs. Cape Town, per 100.	Eggs. Durban New Laid, per dozen.	Hides (per lb.). Port Elizabeth. 1st Grade, Sun-dried.	Hides (per lb.). Port Elizabeth. 1st Grade, Dry Salted.	Skins. Port Elizabeth. Merino. Medium, per lb.	Skins. Port Elizabeth. Merino. Combings, per lb.	Skins. Port Elizabeth. Glovers, Sound, per skin.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938-39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940-41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941-42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·5	9·7	3 4
1943—									
January	1 8	1 4	13 11	2 2	8·0	8·1	5·7	9·1	3 4
February	2 3	1 11	16 7	2 7	8·1	8·1	6·1	10·5	3 5
March	5 9	2 3	19 4	3 2	7·8	7·9	5·9	10·8	3 4

Prices of Apples, Pears and Grapes on Municipal Markets.

…ON …uly to …n June).	Apples (Bushel box). Johannesburg. O'Hemi-muri.	Johannesburg. White Winter Pear-main.	Johannesburg. Wem-mers-hoek.	Cape Town. O'Hemi-muri.	Cape Town. White Winter Pear-main.	Cape Town. Wem-mers-hoek.	Pears (Bushel box) Johannesburg. S.M. No. 1	Pears (Bushel box) Johannesburg. Other.	Grapes (Tray). Johan-nesburg. Johan-nesburg.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	7 2	6 0	5 10	7 3	8 0	4 3	6 7	4 2	1 3
1940-41	8 4	7 1	6 4	8 11	10 8	5 7	8 11	6 3	1 8
1941-42	8 11	7 11	7 3	9 1	10 9	6 9	7 3	[illegible]	1 11
1942—									
January	—	—	—	—	—	—		7 5	3 2
February	8 3	—	12 2	8 10	—	—	7 3	7 8	1 6
March	7 5	6 11	7 6	7 7	9 3	6 3	5 6	7 0	1 10
April	8 6	7 6	6 8	7 9	9 8	6 2		9 6	1 11
May	8 10	7 7	6 5	8 9	9 7	5 8		8 11	2 9
June	10 1	8 10	8 4	9 7	10 9	6 3		15 9	2 6
July	11 2	11 4	8 1	10 10	12 1	8 11			[illegible]
August	17 6	15 8	10 6	11 7	11 8	9 10			
September	16 4	16 3	7 0	11 11	11 3				
October	16 6	16 3	—	9 11	9 4				
November	20 8	18 6	—	10 4	7 2	—			
Desember	19 7	17 8	—	11 10	17 5	—		14 10	[illegible]
1943—									
January	—	17 5	—	11 5	—	—		[illegible]	[illegible]
February	10 1	11 0	14 4	8 11	9 0	4 11		9 10	1 5
March	8 5	10 1	8 10	9 2	11 8	5 9		[illegible]	[illegible]

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

Season (1st July to 30th June).	Green Beans (Pocket 20 lb.). Johan-nesburg.	Green Beans Cape Town.	Green Beans Durban.	Green Peas (Pocket 20 lb.). Johan-nesburg.	Green Peas Cape Town.	Green Peas Durban.	Carrots (Bag). (a) Johan-nesburg.	Carrots Cape Town.	Carrots Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 1
1940-41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	13 4
1941-42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 6
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	10 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 0	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 0	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	5 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10
1943—									
January	1 9	3 3	3 5	2 4	6 9	4 7	3 9	5 1	11 3
February	2 5	4 4	3 10	4 8	5 9	5 1	6 0	6 5	11 4
March	2 8	3 1	1 6	6 7	4 5	3 10	7 9	4 6	13 [illegible]

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

Average Prices of Oranges and Paw

Season (1st April to 31st March).	Oranges (Pocket). Johannesburg. N.M. Navels.	Johannesburg. Other. Navels.	Johannesburg. Other. Valencias.	Cape Town. Navels.	Cape Town. Valencias.	Durban. Navels.	Durban. Valencias.	Jo. N.M.	
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 10	1 6	1 5	2 0	2 1	—	—	2 0	1 7
1940-41	1 9	1 7	1 6	1 11	1 10	2 4	2 1	2 2	1 9
1941-42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1941-42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1942—									
January	—	2 6	3 8	2 10	4 7	—	3 11	3 3	2 1
February	—	3 11	4 5	4 7	6 10	3 9	5 8	6 4	3 3
March	—	3 7	2 11	6 6	5 10	4 3	5 6	4 1	3 1
April	2 1	2 0	1 10	3 4	5 0	3 4	2 6	4 0	3 1
May	2 4	2 3	2 1	2 3	2 3	2 6	1 2	3 8	3 1
June	2 3	2 3	1 9	2 1	—	2 6	1 11	2 11	2 5
July	2 5	2 5	1 11	2 1	—	2 8	1 0	2 8	2 2
August	2 11	2 8	2 3	3 0	2 1	3 6	2 4	2 2	1 8
September	2 5	3 3	2 3	3 4	2 2	4 0	2 6	2 1	1 6
October	2 9	2 11	2 7	5 1	3 1	3 7	2 11	2 4	1 9
November	—	3 6	4 0	6 11	3 7	4 6	3 6	3 1	2 6
December	—	3 1	3 8	2 11	4 3	—	4 2	3 5	2 1
1943—									
January	2 0	3 8	4 0	—	4 10	2 4	3 9	3 9	3 0
February	7 1	5 8	5 3	—	7 6		4 9	4 11	3 6
March	5 11	5 4	4 1	6 6	8 6	3 3	5 8	5 2	3 9

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb. (a) Johannesburg. N.M. Prime.	(a) Johannesburg. Ordinary Prime.	(a) Johannesburg. Good Medium.	(a) Johannesburg. Compounds.	(b) Durban. Medium.	(b) Durban. Compound.	Pigs per lb. Live Weight. Johannesburg. Porkers, Prime.	Johannesburg. Baconers, Prime.	Johannesburg. Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938-39	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940-41	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941-42	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942—									
January	63 2	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June	56 6	53 5	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September	69 0	65 4	60 3	49 2	53 8	41 8	6·8	8·5	6·4
Oktober	75 1	71 3	65 6	51 2	56 2	39 10	7·7	8·3	7·5
November	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Con'rol Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.

of Sheep per lb. Estimated Dressed Weight.*

...o ...JN ...y). ...uly ...a Jr	Johannesburg.				Cape Town.			
	Merino Wethers.		Persians and Cross Breds.		Merinos.		Capes and Persians.	
	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
938–39..........	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940–41..........	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941–42..........	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·9
1942—								
January........	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February.......	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·7
March..........	9·6	8·4	8·8	7·9	9·6	8·8	9·5	8·8
April..........	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·9
May............	9·1	7·9	8·1	6·9	9·0	8·3	9·0	9·4
June...........	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July...........	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August.........	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September......	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
Oktober........	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November.......	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December.......	12·3	10·2	10·3	8·7	10·9	10·2	10·[illegible]	10·4
1943—								
January........	11·2	9·4	9·5	8·3	10·8	9·[illegible]	10·4	9·4
February.......	10·5	8·6	8·2	6·5	10·1	9·3	10·4	9·1
March..........	11·5	9·8	9·0	7·3	11·7	10·6	11·1	10·7

* As sold on the hoof. Reported by Meat Control Board.

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

Season (1st July to 30th June).	Cabbages (bag). (a)			Cauliflower (bag). (a)			Tomatoes (Trays 15 lb.)			
							Johannesburg.			
	Johannesburg.	Cape Town.	Durban.	Johannesburg.	Cape Town.	Durban.	N.M. No. 1.	Other.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39.........	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940–41.........	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941–42.........	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1942—										
January.......	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February......	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March.........	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April.........	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May...........	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June..........	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July..........	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August........	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
September.....	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
October.......	4 2	6 10	2 5	—	4 9	5 5	2 6	1 5	2 0	1 4
November......	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10
December......	3 11	7 10	3 2	—	4 0	—	3 8	1 10	3 0	2 4
1943—										
January.......	5 1	9 0	12 6	—	—	—	4 11	2 4	2 0	2 8
February......	6 4	10 2	15 2	5 7	5 8	—	5 5	2 7	1 8	2 11
March.........	5 6	9 6	8 6	6 6	5 11	—	3 11	1 9	1 10	2 7

(a) Weights of bags vary, but on the average are approximately as follows: For cabbages: Johannesburg, 105 lb., Cape Town 105 lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 85 lb., and Durban 85 lb.

SPECIAL FRUIT-PRODUCTION NUMBER (Winter Rainfall Area).

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CONTENTS

ᴊrmation on Departmental Publications.

arming in South Africa, the monthly journal of the Department, contains popular as ɹl as scientific articles on a variety of agricultural topics, useful to both the farmer nd the housewife, while the **Crops and Markets** Section, supplies information on crop prospects, market prices and exports of agricultural produce.

The following particulars in regard to subscriptions and advertisements should be noted:—

Subscription.—Within the Union, South West Africa, Bechuanaland Protectorate, Southern Rhodesia, Swaziland, Basutoland, Mocambique, Angola, Belgian Congo, and British Territories in Africa 5s. (otherwise 7s. 6d.) per annum, post free, payable in advance.

Applications, with subscriptions, to be sent to the Government Printer, Koch Street, Pretoria.

Advertisements.—*The Tariff for Classified Advertisements is:* 2d. (two pence) a word with a minimum of 5s. per advertisement (prepaid). Repeats, not entailing any change in the wording, will be published at half the cost of the original.

Conditions:—

(1) The advertisement will be classified under specific headings, and only one black letter (initial letter) is permitted.
(2) Advertisements in which prices are mentioned must contain the name and address of the advertiser. A nom-de-plume or box number only is not sufficient, and unless this condition is strictly observed advertisements will not be accepted.
(3) Advertisements will be classified strictly in accordance with the subject matter of the announcement, determined by the first item mentioned, and cannot be inserted under irrelevant headings.
(4) Displayed, classified advertisements will also be accepted. The charge however, will be 15s. per inch, single column, per insertion, without reduction for repeats.

Copy for Advertisements to be in the hands of the Government Printer, Pretoria, not later than the 20th of the month preceding publication.
Send all advertisements direct to the Government Printer, or write to him for details as to tariff for advertisements.

Popular Bulletins.—Bulletins on various agricultural topics are published by the Department to meet public demand. A list of available bulletins giving particulars of cost, etc., is obtainable free of charge from the Editor, Department of Agriculture and Forestry, Pretoria.

Scientific Publications.—From time to time the different Divisions of the Department issue science bulletins incorporating the results of research work conducted by them. Other scientific publications issued are: "The Onderstepoort Journal", "Memoirs of the Botanical Survey of South Africa", "Bothalia", "Entomological Memoirs" and the "Annual Reports of the Low Temperature Research Institute". Information in regard to these publications is obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Press Service.—The Press of South Africa is now supplied with a bulletin of agricultural information for their exclusive use. This information is published fortnightly by all newspapers and other journals throughout the country.

Farmer's Radio Service.—In addition to the printed information supplied by the Department to members of the farming community, the Department, in collaboration with the South African Broadcasting Corporation, also maintains a daily broadcasting service to farmers. Information in regard to times of broadcasting is contained in the programmes issued by the Broadcasting Corporation.

Inquiries.—All general inquiries in regard to the publications of the Department, including the Radio Service, should be addressed to the Editor, Department of Agriculture and Forestry, Pretoria.

D. J. SEYMORE, Editor

Special Fruit Producti Number.

The Fruit Grower under Present Conditions.

A Policy Indication by Dr. M. S. du Toit, Director of the Western Province Fruit Research Institute, Stellenbosch.

SINCE the outbreak of the war and the resulting cessation of export, it has become a habit with many to pity the lot of the fruit grower and to paint the future of the fruit industry in the darkest hues.

The problems which beset the fruit grower are indeed formidable and it would be unwise to underestimate their gravity. The export trade to which the fruit industry owed its phenomenal development and upon which its very existence depended, had disappeared overnight, leaving an undeveloped local market as the sole channel of disposal. Export varieties were not only less desirable on the local markets, but were also less suited for canning and drying. The industry had, in fact, not given the necessary attention to processing and subsidiary channels of disposal during the period of successful export, and found itself unprepared to handle the large surplusses of fresh fruit. The crisis indeed only exposed what many had realized for a considerable time, namely, that the development of the industry was one-sided and unbalanced and its foundations insecure. A shortage of labour, packing and spraying materials, fertilizers and a variety of other essential requirements was not calculated to ease the position, while a previously undreamed of degree of control had become part of his daily existence.

Although the solution of the problems of the fruit industry will demand the utmost endeavour of each grower, there is no reason for despair as long as the same energy, out of which the pre-war export trade was born, still exists and the independent spiritedness so typical of Western Province farmers still survives.

The privilege of owning a farm brings problems and responsibilities which are nothing new in this country. Indeed, only by defying droughts, pests and disasters has agriculture managed to survive. Fruit growers can still shape their own future, if they are willing to sacrifice much to be masters in their own house once again.

The fruit industry is standing at the cross roads, and its future development will depend on its ability to adapt itself to the changing economic conditions of the day.

To attain this end there will have to be a change of method as well as a change of psychological outlook, only a few broad aspects of which can be indicated here.

1. *Organization of the Industry.—No industry can successfully reshape and re-orientate itself unless its organization has the whole-hearted support of the large majority of its members. At a time like this it is the duty of every grower to support his organization, whatever its constitution, with assistance and sound and constructive suggestions, and also the duty of each area to make its farmers' bodies*

d as active as possible. The far too prevalent notion ...ution of the problems of the industry is the business of ...uous Fruit Board alone, is unsound. It is as much the ..., the individual grower and of his local organization.

2. *Government Assistance.*—The considerable financial assistance which the government has already granted the fruit industry since the outbreak of the war, has imposed on the latter the obvious responsibility of using it constructively and of building something of lasting value. Already local markets have, as the result, been exploited as never before. Permanent works like drying yards and dehydration plants for fruit and vegetables, and co-operative wineries have been constructed and a sawmill placed at the disposal of the industry.

To regard this assistance as the duty of the State towards the fruit grower betrays a state of mind which will not lead to an industry which will ultimately stand on its own feet.

The grower who neglects pruning, thinning and other essential cultural practices and, above all, who does not gradually organize his own farm in the light of present economic conditions, is certainly not using this assistance constructively.

3. *Fruit Soils.*—As the result of the high fruit prices of the past, soils have been planted to fruit trees and vines which even before the war were gradually becoming sub-economic. There is, therefore, no reason for hoping that these will not remain marginal in future under present systems of cultivation.

The elimination of marginal land is the first step on the road to rehabilitation and it is the duty of every grower to himself, the industry and the State, to take the task in hand, as no one ought to know the cropping ability of his soils better than the farmer himself.

4. *Varieties.*—The deciduous fruit industry is characterized by the great diversity of varieties found on each farm. Although, as the result of lack of adequate information, this may originally have been unavoidable, there is no need for it to-day. Many orchards are being kept alive long after they have ceased to fulfil any useful function, because of climatic unsuitability or unpopularity for marketing purposes.

In the choice of varieties, not only climatic and soil suitability but cropping power and marketability are obviously of primary importance. No business can survive if it cannot adapt itself to the changing economic conditions of the times. The very nature of fruit farming, involving, as it does, long periods between planting and coming into bearing, tends to make it, as a business, non-liable and static. In choosing varieties it is, therefore, doubly important to avoid single-purpose fruits and to concentrate on those types which are suitable for dessert as well as for processing purposes. Highly effective methods for top working and grafting exist to-day, and growers are advised not to postpone the task.

5. *Orchard Practice.*—With present limited supplies and facilities, everybody has perforce to make the best of a difficult situation. It would, however, be nothing short of tragic if permanent assets are for this reason neglected. Every effort must be made to maintain worthwhile orchards and vineyards. Even before the war and the present labour shortage, many a grower had so many varieties in his orchards that he could not adequately cope with the crop. The result is that he commences picking too green and ends

by picking too ripe, with a consequent lowering standard of his crop.

Under present methods of disposal there is a tend indeed the temptation to neglect thinning and pruning op and to agitate for a lowering of grades. It would be difficult to a practice more damaging to the tree, the quality of the fruit its successful marketing.

6. *Farming System.—Farming systems will undoubtedly have to be reviewed. In some sections of the western Cape Province a degree of intensification and specialization has already taken place, which threatens the economic stability of the industry. It is highly doubtful whether fruit-farming can be practised successfully in this area on a few morgen of land, as neither climate, soil nor water supplies are adequate for such intensive cultivation. A greater degree of mixed farming will have to become part of the fruit-framing system of the future. It is, apart from marketing problems, also a matter of organic matter supplies and a shortage of nitrogen reserves in the soil. Progressive soil deterioration, in spite of the use of increasing quantities of artificial fertilizers, is a far more serious problem than most growers realize. Any farming system which results in the total disappearance of farm animals, the art of making farmyard manure and the home production of food for farm workers, needs re-examination.*

7. *The Duty of Fruit Growers.—The fruit industry can rehabilitate itself if its urgent problems are recognized and faced in a spirit of co-operation. The existence of a Deciduous Fruit Board is no reason why co-operative endeavour in the different fruitgrowing sections must languish and disappear. The fruit growing areas are circumscribed regions within which there is a great degree of common interest and, therefore, conducive to successful co-operative activities. The possibility of central packhouses, cold stores and processing plants must be actively explored. Indeed many farming practices, such as pruning, can with present labour shortage, be done co-operatively if there is the necessary degree of mutual understanding.*

Fruit prices will in all probability never again reach their pre-war level. Luxury methods and luxury products have had their day, and with it the artificial division of the fruit industry into exporters and non-exporters and its resulting " export " mentality. The aim must be to deliver sound eatable and sought-after products to the masses in containers suited to local marketing conditions, and to reduce costs of production to a minimum.

It cannot be sufficiently stressed that the duty of the fruit industry is to utilize government assistance and the relative security afforded by a fixed intake price in such a manner that something of permanent value will have been achieved when the present era of subsidization comes to an end.

To agitate, on the other hand, for high intake prices which would encourage the cultivation of marginal land, and for lowered grades which would make it profitable to neglect pruning and thinning, is to place the fruit industry in a permanently dependent and uneconomic position.

W. S. du Toit

Director.

...ce of Climate upon Fruit Production.

... B. D. de Villiers, Fruit Research Institute, Stellenbosch.

...OR steady commercial production and sound appearance, exceptional quality and unsurpassable keeping ability of the fruit, particular demands are made by the apricot, plum, peach, pear and apple tree on the physical environment.

Climatic conditions during the ripening of the wood, the rest period, the flowering and fruit-setting periods and the active growth period of both the tree and the fruit, exercise a most important influence on the quantity as well as the quality of the ultimate product.

Weather conditions from the ripening of the wood to the setting of the fruit mainly determine the size of the crop (apart from inevitable loss from winds later in the season), while meteorological factors during the active growth period chiefly influence the quality and keeping ability of the fruit.

It will readily be understood that every kind of fruit as well as every variety will make its own demands upon the physical environment during each of the above-mentioned periods, and it is for the fruit farmer to see that the right variety is planted in the most suitable situation.

In the past, this particular aspect of the fruit industry was very often neglected with disastrous results. Apple and pear trees had to give way to peach and plum trees and ultimately, after costly experience, the fruit grower concluded that the vine thrived the best.

Times have changed. To-day the climate of the fruit-growing areas of the western Cape Province, as well as the climatic requirements of the different fruits, are mostly known and the fruit farmer can draw upon this knowledge for his own welfare and the common good of the fruit industry.

Qualitative Production.

A deficiency in the cold requirements during the rest period of the deciduous fruit tree is the most outstanding climatic factor determining the size of the crop in the orchards of the western Cape Province. This rest period coincides with the two winter months June and July. If the necessary amount of cold is not experienced during winter, the tree, on commencing growth in the spring, shows the well-known signs of delayed foliation with which low production is generally associated.

It has been determined that if the mean temperature at Stellenbosch for June and July exceeds 54° F., delayed foliation may generally be expected.

Since the majority of the fruit-growing areas lie between latitudes 33° and 34° South neither intense heat in summer nor excessive cold in winter may be expected. The mean monthly maximum temperatures range from 80°-90° in January to 60°-65° in June and July, while mean monthly minimum temperatures decrease from 55°-60° in January to 33°-50° in June and July.

Altitude is the principal geographic feature determining the hotness of the summer and the coldness of the winter. Consequently, a close connection exists between altitude, minimum winter temperatures and delayed foliation. If the fruit-growing districts are arranged in the order of increasing mean minimum temperatures for

June and July, they group themselves in the ord... susceptibility to delayed foliation.

This striking relationship bears out the importance o... mum temperature prevailing in each district. The lower t... mum temperatures, or the greater the cold experienced in w... the more suited is that district for the growing of deciduous ... trees.

On a basis of minimum temperatures for the months June and July, the fruit-growing areas of the western Cape Province can be classified into the following three groups:—

Group I.—Areas with minimum temperatures lower than 40° include:—

(*a*) The Cold Bokkeveld: 33·5°,
(*b*) The Ceres Basin: 35·5°,
(*c*) Montagu: 37·3°,
(*d*) Elgin: 37·4°,
(*e*) The Hex River Valley: 39·8°.

From a delayed foliation point of view, these districts are the best fruit-growing areas, and trees are affected by this climatic malady only after the warmest winters. These are the most suitable areas for the growing of pears and apples which require good chilling conditions during the rest period.

The mean temperature for June and July ranges from 45° at De Keur (Cold Bokkeveld) to 53·2° at Montagu.

Group II.—Areas with minimum temperatures between 40° and 44° include:—

(*a*) Banhoek: 41·4°,
(*b*) Franschoek: 42·7°,
(*c*) Worcester-Robertson: 42·8°,
(*d*) The Groot Drakenstein Valley: 43·4°,
(*e*) The Tulbagh-Wolseley Basin: 43·5°.

These inland districts are all subject to delayed foliation after mild winter weather. To ensure good annual yields only varieties of plums, peaches and other fruits that have a moderately light rest period should be grown.

The mean temperature ranges from 52·4° at Banheok to 54·1° in the Groot Drakenstein Valley. The mean temperature for Groot Drakenstein approaches the critical temperature of 54° very closely.

Group III.—Areas with minimum temperatures higher than 44° include:—

(*a*) Paarl-Wellington: 44·3°,
(*b*) Stellenbosch: 44·5°,
(*c*) Somerset West: 44·6°,
(d) Constantia: 49·6°.

With the exception of Paarl-Wellington, these areas lie close to the sea and, consequently, have relatively high minimum temperatures. The temperatures at Groot and Klein Constantia are particularly high. Constantia is unsuitable for the growing of deciduous fruit. It is chiefly a grape-producing area.

The mean temperatures for Paarl-Wellington-Stellenbosch, Somerset West and Constantia are 54·4°, 54·8°, 54·7° and 56·8° respectively. In each case the mean temperature lies above the critical temperature of 54°.

..osch, Somerset and Paarl only deciduous fruit that ..ittle chilling during the rest period can be grown with ..om a climatic point of view, Somerset West is a grape-..g district; climatically, Stellenbosch and Paarl are also suited for the grape than for deciduous fruit.

Summing up: With the exception of the Cold Bokkeveld, the ..eres Basin, Montagu, Elgin and the Hex River Valley, the fruit-growing areas of the western Cape Province are suitable only for those fruit varieties that require a very light chilling during the rest period and are resistant to delayed foliation. From a climatic point of view these districts are better suited for the grape. In fact, there is not the least doubt that deciduous fruit-growing in the Stellenbosch, Somerset West and Constantia areas is a hazardous commercial undertaking. These three areas undoubtedly belong to the vine. The future of the fruit industry in the other districts lies in the development of new varieties resistant to delayed foliation through hybridization.

Qualitative Production.

Summer conditions, on the other hand, especially temperature and humidity, mainly determine the quality and keeping ability of the fruit.

As a result of their adaptability, deciduous fruit trees can thrive under the most divergent conditions of summer climate. For the best quality and keeping properties, however, different fruits demand certain requirements in regard to temperature and humidity.

The pear demands high summer temperatures. For the best quality and keeping ability the mean temperature must be between 75° and 80°. Between 70° and 74° the fruit still ripens evenly and possesses a good texture, but there are signs of a decline in keeping quality. Between 65° and 69°, the keeping quality is decidedly poor. Of the five best fruit-growing areas (group I), Ceres and the Hex River Valley approach this requirement very closely in so far as summer temperature is concerned. In these two areas, the mean temperature for December, January and February is approximately 72°. If humidity is taken into consideration, Ceres, from a climatic point of view, is the best of these two areas for the growing of pears.

In contrast with the pear, the apple demands relatively low summer temperatures. For best quality and keeping ability, temperatures between 65° and 70° are desired. Above 75° the quality is, on the whole, poor and the fruit subject to damage (internal browning). Between 62° and 64° the fruit colours satisfactorily and ripens well, but is small. Low temperatures may also delay wood maturity with disastrous results. The Cold Bokkeveld and the Koo (Montagu) approach these desired conditions very closely. The mean temperature for December-February is approximately 67°. Consequently, these two districts are then also the best apple-growing areas.

The mean temperature for Elgin is 66°. Elgin, however, owing to its altitude and proximity to the sea, had the highest humidity of all the fruit-growing areas during the summer months. It is undoubtedly due to this high humidity that apples from Elgin are subject to such physiological water diseases as bitterpit, for example. In the direction of Villiersdorp, on the other hand, where the humidity is lower, the apple does better in this respect.

The peach, in contrast with the apple, however, demands very high summer temperatures. Peaches of very good quality and keeping ability are obtained where the temperatures are above 75°, but

where the temperature is 65°, the quality is not too ... keeping ability very moderate. Not one of the five best a... this climatic requirement. Groot Drakenstein (group I... mean temperature of 91° for November-December, approac... nearest to this requirement. Owing to delayed foliation, how... Groot Drakenstein is an uncertain area. A good crop is likely o... three times in every ten years.

The plum apparently demands summer temperatures between 62° and 68°. The districts that satisfy this requirement are: Elgin (64·5°), Banhoek (66·0°), Constantia (66·1°), Stellenbosch (66·7°) and Franschhoek (68·3°). (Temperatures for November-January.) Low vapour pressure deficiencies over the first three areas, are undoubtedly responsible for the excessive occurrence of Kelsey Spot on plums.

The apricot demands temperatures between 69° and 73°. Consequently, if winter conditions are favourable, the apricot thrives very well at Wolseley, Groot Drakenstein and Wellington. The mean temperatures for December at Wolseley and Groot Drakenstein are 69·4° and 70·5° respectively.

The vine is the least exacting in regard to its climatic requirements. Summer temperatures between 65° and 75° are suitable. Excellent quality export grapes with good keeping ability are produced in the Hex River Valley where the temperature averages 71°.

Rainfall Requirements.

The fruit-growing areas of the western Cape Province form practically the whole of one of the five world regions enjoying a Mediterranean climate. The annual rainfall, of which 70-80 per cent. is precipitated during the winter months (April to September), ranges from 10-12 inches at Worcester and de Doorns to 35-36 inches at Elgin and Ceres.

For successful production and good growth, deciduous fruit trees require sufficient available soil moisture in the root zone during the growing season.

Fruits that ripen early, e.g., the apricot, can be grown with less water than those fruits which ripen later, e.g., the peach, apple and pear.

An annual precipitation of 25-30 inches is essential. If the rainfall is insufficient, it must be supplemented by irrigation at the correct time.

The Future of Fruit Production.

Since 1934 complaints regarding delayed foliation have steadily increased. The 1934-35, 1936-37 and 1938-39 seasons were in increasing order, years of poor production for susceptible varieties. At Stellenbosch the mean temperature for June and July was 55·2°, 55·5° and 57·7° respectively. The 1938-39 season was certainly the worst in the history of delayed foliation—the flowering and leafing of susceptible varieties were greatly delayed and crop production was extremely poor. This occurred in practically all orchards of the western Cape Province.

A study of the minimum winter temperatures of Groot Drakenstein since 1900 has brought to light the fact that in 1931 winter temperatures averaged well below normal and that since this year the trend of these temperatures has been to increase steadily to a peak in 1938. It is not surprising then that since 1934 the number of complaints concerning delayed foliation has continually increased.

[Continued on page 392.

..onomical Deciduous Fruit Varieties.

M. W. Black, Fruit Research Institute, Stellenbosch.

THE basis of profitable fruit farming is a high and regular production per morgen. Without stable production, the industry cannot survive. This fact is of special significance in regard to the post-war period when export and competition on the world markets will have to be resumed under less favourable conditions. If the industry is taken as a whole, it could be said that the average production per tree in South Africa is much too low, and in this respect

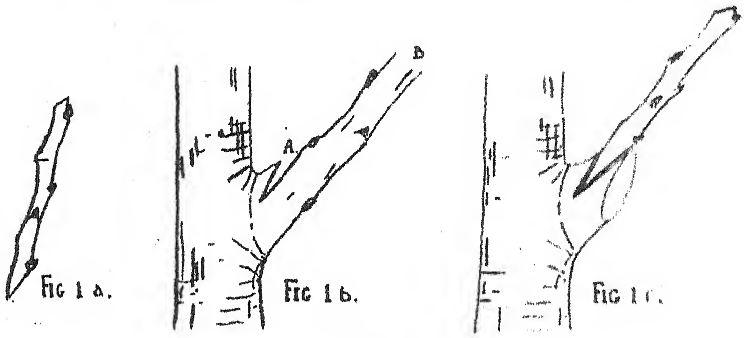

Fig. 1.—Stub grafting.

compares unfavourably with that of many other fruit producing countries. The chief reason for this state of affairs is the high proportion of our trees and orchards which yield poor and unprofitable crops.

Of the many factors which influence the production of a tree, e.g., soil, nutrition, rootstock, etc., the most important is undoubtedly the variety and its adaptation to climatic conditions. If a variety is unsuited to a certain climate and, as a result, produces poor crops, no amount of cultivation or irrigation will rectify matters. In the older fruit producing countries, e.g., Europe and America, each fruit growing area concentrates mainly on a few varieties which have been proved through good fruiting properties to be the best suited to that particular environment.

This is the result of a kind of natural selection taking place throughout the centuries.

In some cases this evolution has already developed to such an extent that totally different varieties are often grown in neighbouring districts with only a slight difference in climate. Such a state of affairs is very seldom encountered in this country. The reason is perhaps to be found in the rapid development of the fruit industry during the peak years of export, when prices soared sky high. Especially after the last war new orchards were laid out on an unprecedented scale. This extensive development resulted in the introduction of every possible overseas variety of fruit. Only afterwards did it appear that many of these varieties were quite unsuited to our conditions. For many years this country suffered from an overseas complex—everything that was planted, say in California and Australia, had to be grown here without taking into consideration whether these varieties were suited to our conditions or not. Too

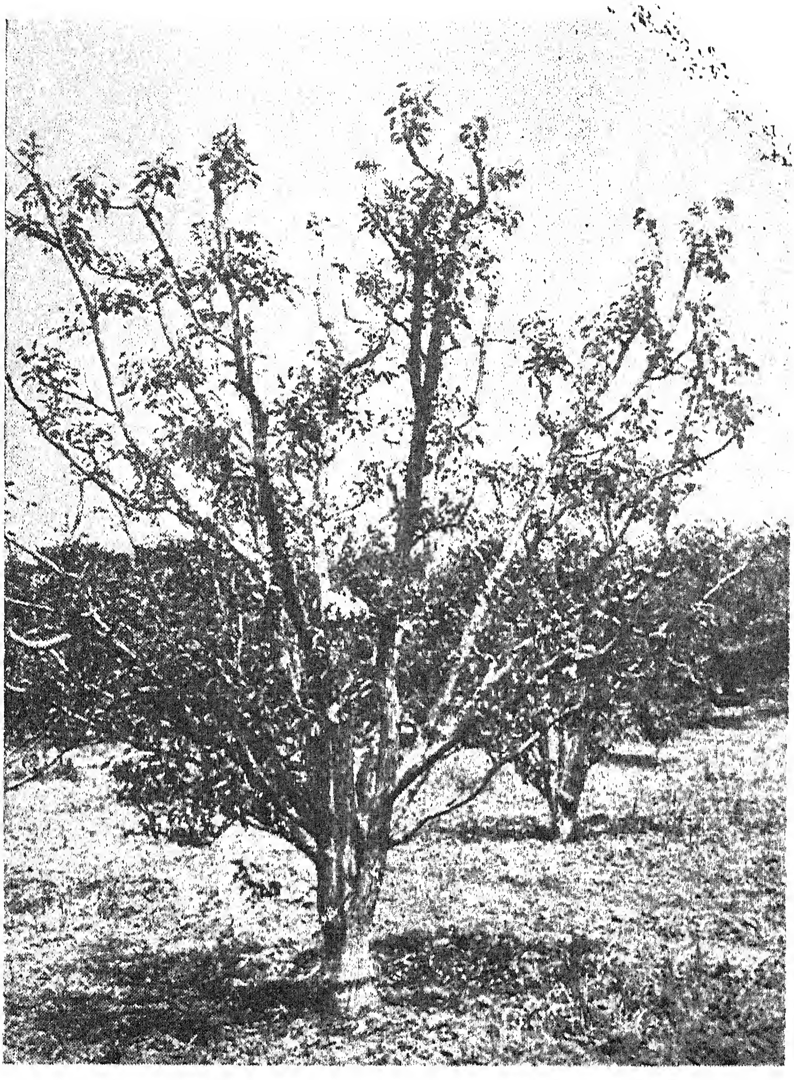

Fig. 2.—Pear tree—2 months after stub grafting.

often it is forgotten that some of our best commercial varieties originated in our own country, e.g., Early Dawn, Inkoos, Kakamas peaches; Methley plum; Wemmershoek apple, etc.

Even to-day there are still farmers who choose varieties for their orchard merely because of the picturesque descriptions in the nurserymen's catalogues without first finding out whether these varieties would thrive on their farms. Often growers are also inclined to plant a great assortment of varieties. It is well-nigh impossible for all these varieties to thrive equally well on any particular farm. Moreover, it is more economical to produce a crop from many trees of a few selected varieties than from a few trees of a great many varieties.

Furthermore, it should be borne in mind that in regard to climate, the Western Province is practically on the border line for

deciduous fruits. Hence extra special care should selecting varieties for the orchard. Owing to the mild itions, many of our fruit regions are subject to "delayed . which is the main reason for low yields in the Western nce. According to de Villiers (see article in this issue) our areas in the Western Province can be divided into three main gions, according to delayed foliation, viz.:—

(1) The high areas [Cold Bokkeveld, Ceres, Montagu (Koo), Elgin, Hex River], where delayed foliation is never very serious.

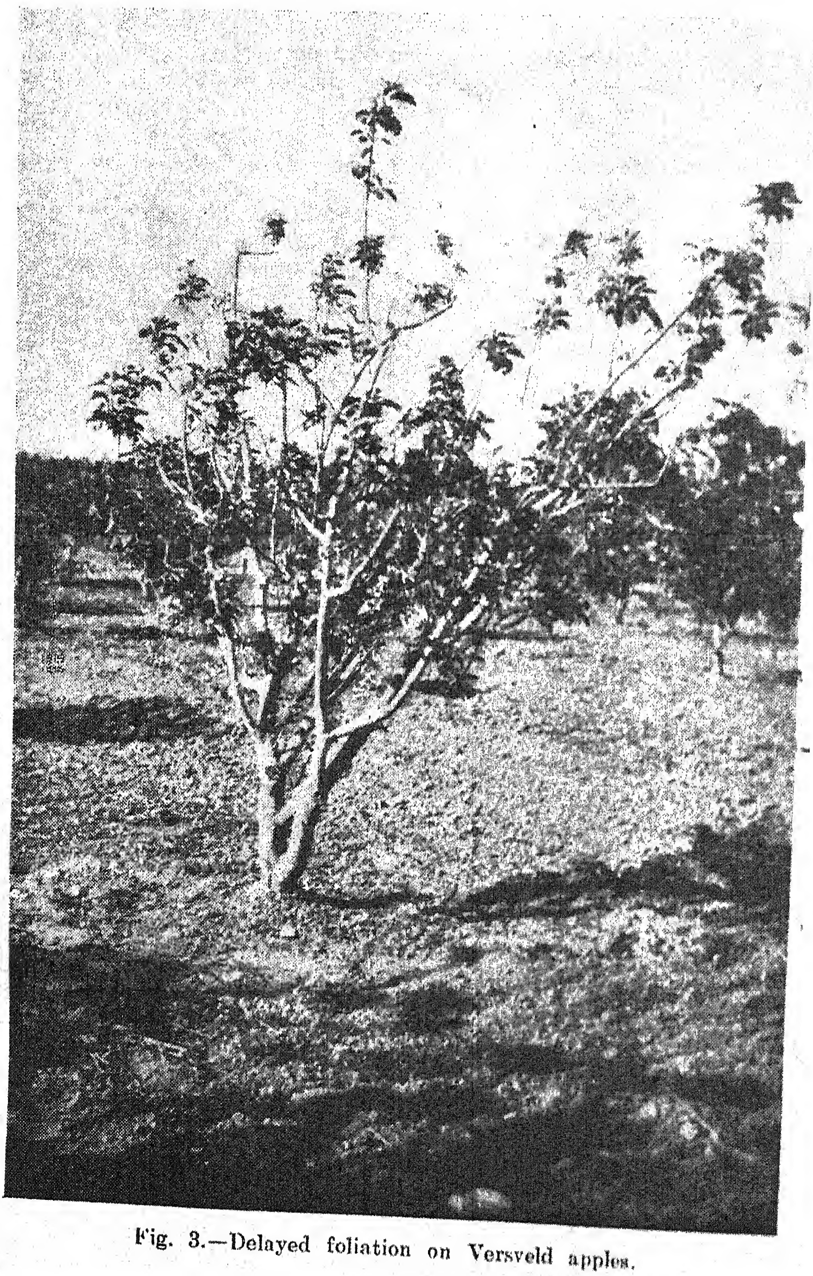

Fig. 3.—Delayed foliation on Versveld apples.

(2) Intermediate areas (Franschhoek, Banho... Robertson, Tulbagh, Groot Drakenstein) where a fa... delayed foliation occurs.

(3) Low-lying coastal areas (Paarl, Wellington, Stel... Somerset-West, Constantia), where delayed foliation is a very ... problem.

In each of these regions, however, marked local variations i... climate occur; it may even happen that on one and the same farm two orchard sites may show striking differences in regard to delayed foliation. Generally speaking, it can be assumed that the selection of varieties becomes more limited the more the area is subject to delayed foliation. Of the large number of varieties grown in the Western Province to-day, by far the great majority is subject to delayed foliation.

Peaches and Pears.

Taking the peach as an example, there are about seventy different varieties grown in the winter-rainfall area, and of these only a dozen, at the most, are actually worth growing. Of these only a very few can be grown successfully in the low-lying areas, e.g., Early Dawn, Kakamas, Babcock. In the intermediate region varieties like Inkoos, Elberta and perhaps Pucelle can in addition be cultivated. Varieties such as Peregrine, Muir, Tuscan Cling, Philips Cling can be grown successfully only in the higher areas. Some varieties, such as Duke of York and Early Alexander are subject to delayed foliation to an exceptional degree and are often a failure even in some of the higher areas, such as Elgin. Nevertheless, every possible peach variety is still to be found to-day in the different areas—the result is that many of these trees are a loss to the farmer and a drag on the industry.

What is the position with regard to pears? More than forty varieties of pears are grown to-day in the Western Province, and of these the great majority can be eliminated on account of inferior commercial value and poor adaptability. There are actually only six outstanding pear varieties to-day, viz., Bon Chretien, Beurre Bosc, Beurre Hardy, Packham's Triumph, Winter Nelis and Keiffer. Even these six varieties are not equally satisfactory everywhere, e.g., in the coastal areas Keiffer, Packham's Triumph and Beurre Bosc are the heaviest and most regular producers. Varieties such as Bon Chretien and Beurre Hardy are less suitable on account of delayed foliation.

The position as set forth here for peaches and pears also holds good for other kinds of deciduous fruit.

Elimination by Top-working.

The solution of the whole problem is obvious; unprofitable varieties must simply be eliminated and, where possible, be replaced by varieties better suited to that particular area. The most economical method by which this may be accomplished is top-working. Top-working, however, will be successful only when the tree is vigorous and healthy. Where this is not the case, it would be better to uproot the old tree and plant a young one of the desired variety in its place. Stub-grafting is the best way of top-working trees like pears, apples and plums. Its greatest disadvantage lies in the high cost involved, but this will be doubly repaid by early cropping, heavy yields and by the fact that very little of the original tree size is sacrificed in the process of grafting. The cost of stub-grafting will depend to a large extent on the size of tree, the number of scions used and the skill of the grafter. Stub-grafting a full-

Fig. 4.—Normal apple tree.

sized pear tree might cost anything from 2s. to 4s. The cost will, of course, be much less when the trees are smaller. The work itself is simple and the ordinary farm labourer can easily be taught to do the work. Unless peach and apricot trees are still fairly young, it hardly pays to top-work them. Top-working here is best done by means of budding; the trees are simply cut back heavily in winter and buds placed in the young growing shoots in summer.

The question may arise whether it would pay the farmer under present conditions to go to the expense of replacing his low-yielding

trees with more profitable varieties. At the present ... of fruit is to a large extent controlled, and many far... find it safer to continue as in the past. Even varieties whi... war days were of inferior commercial value are to some extent ... to-day by the fixing of prices. Furthermore, the labour sho... is also a matter to be considered to-day. On the other hand, t... farmer must realize that a low-yielding tree or an inferior variety can never be an economical proposition. Consequently, the only sensible policy for the grower would be to replace such trees with better varieties to the extent that his financial and labour facilities will allow. This should be his best investment for the future.

New Varieties.

There still remains the question of new varieties. The dangers of indiscriminate importation of new varieties have already been stressed. Most of the imported varieties have originated in cold climates and are thus liable to be subject to delayed foliation in this country. To place the whole question of new varieties on a sound basis, this Institution has imported a large number of promising varieties, especially with respect to delayed foliation from North and South America, Australia and other countries.

These varieties are now being compared under local conditions with our own standard varieties. Experiments are also being carried out with promising types and varieties that have originated in South Africa. As is well known, the Kakamas peach was selected in this manner as a promising seedling from the old Transvaal yellow peach. A considerable amount of breeding work is also being done with the object of obtaining better varieties for the industry.

As soon as any of these varieties prove that they are suitable, they will be made available to the public.

Reprints.

(Obtainable from the Division of Chemical Services, Pretoria.)

No. 19 of 1940.	Fertilizer problems in vegetable production	—
No. 19 van 1940.	Bemesting vraagstukke in verband met groente verbouing	—
No. 53 of 1941.	Lime for agricultural purposes	—
No. 53 van 1941.	Kalk vir landboudoeleindes	—
No. 73 of 1941.	Compost	—
No. 73 van 1941.	Kompos	—
No. 90 of 1941.	Bat manure	—
No. 90 van 1941.	Vlermuismis	—
No. 19 of 1942.	The new fertilizer mixtures	—
No. 19 van 1942.	Die nuwe kunsmismengsels	—
91	Sphere of the chemist in Agriculture (Annual Report 30/6/28)	—
91	Rol van die skeikundige in landbou (Jaarverslag 30/6/28)	—
92	Manuring of wattles: Fertilizer trials with wattles	—
92	Bemisting van wattels: Bemisting proewe met wattels	—
93	South African tanning materials, Part II	6d.
93	Suid-Afrikaanse looistowwe, Deel II	6d.
94	Official soil map of the Union of South Africa	—
94	Offisiële grond-kaart van die Unie van Suid-Afrika	—

Hints on Guava Culture.

du Preez, Fruit Research Institute, Stellenbosch.

THE revelation of Boyes and de Villiers[1] that the vitamin C content of guavas is ten times as high as that of fresh orange juice and the present wartime conditions have greatly increased the demand for guavas, especially for canning. As a result of the very good demand and present high prices, many guava trees are being planted, unfortunately without considering whether the soil and other growth factors are suitable and what the future prospects are likely to be. If planting takes place without careful previous consideration, many pitfalls and disappointments can be expected.

This article is published to serve as a warning and to give certain hints to those who intend planting guavas.

Most of the guava trees in the Western Province are grown in the Paarl District and especially in the Klein Drakenstein and Daljosafat areas on soil which is deep, fertile and under irrigation. For high production and good quality, it is essential to plant on soil where moisture conditions are very favourable. Under no circumstances should available moisture be a limiting factor at the time when the young fruits are setting.

Very often the question is asked which kind of guava should be planted. This is an extremely difficult question to answer as it is almost impossible to order definite varieties from any of the nurserymen. Many of the farmers growing guavas raise their own trees for their own use from the best trees in their orchard and, consequently, many different types of guavas are found.

The Propagation of Guava Seedlings.

In the past, and even to-day, many young trees which have been raised from seed have been, and are still being planted. There is a great difference between such trees with regard to the type of fruit borne and the time of ripening. Every seedling can be looked upon as being a variety on its own and it is due to this fact that in many orchards hundreds of different varieties exist. Even if the seedlings are raised from the seed of one outstanding fruit, the progeny will vary from early to late and from white to pink fleshed types. Such variations in type have been noticed by farmers themselves. Owing to this fact, an urgent appeal is made to prospective guava growers not to make use of seedlings. For the future standardization of a range of varieties, it is essential that trees should be raised vegetatively and not from seed.

In the case of vegetative propagation one or more of the following methods are appied:—(*a*) layers, (*b*) root cuttings, (*c*) hardwood cuttings, (*d*) suckers.

Trees which are propagated by any of the above-mentioned methods will be a true variety and will possess the qualities of the original tree. It appears that attempts to propagate budding the guava by grafting and budding have been made, but thus far the results have not been promising. Research work in propagating the guava is being carried out at this Institution.

(1) Vitamin C Content of Guavas, W. W. Boyes and D. J. R. de Villiers, *Farming in South Africa*, Vol. 17, No. 194, pp. 319-336.

[Continued on page 396.

Berry Fruits.

T. Micklem, Fruit Research Institute, Stellenbosch.

IN the past, berries have not been grown on a large scale in western Cape Province, with the result that berry pulp has had to be imported for the manufacture of certain types of berry jams. Reviewing present day conditions it is felt that every effort should be made to produce enough berries to satisfy the local demand. Therefore, some of the more important cultural practices connected with the production of strawberries, brambles and Cape Gooseberries will be discussed here.

To-day berries are realizing high prices, and their cultivation should be remunerative. Before a grower decides to go in for them, however, the question of marketing should be thoroughly understood. Berries are highly perishable, and unless the grower is situated near a suitable market, it will be impossible to dispose of the crop as fresh fruit. If, on the other hand, the berries are to be grown for factories, arrangements should be made for the disposal of future crops before laying down new plantings.

Strawberries.

There is a good demand for strawberries, both as fresh fruit and for jam-making. The strawberry does best in our cooler localities, and prefers areas where the relative humidity is reasonably high. If there is a low humidity or a spell of drying winds during blossoming time, the fruit sets badly. This is the probable explanation why strawberries do well at Stellenbosch but poorly at Groot Drakenstein, the latter district having a very low atmospheric humidity during the summer.

With strawberry culture the practice of crop rotation is strongly advised. Once strawberries have been grown on a piece of land, then other crops should be grown for a period of at least five years before the land is again used for strawberries. In ordering young plants, the best results are obtained when healthy plants from cool, high altitude districts are used. This is often practised in the western Cape Province, and the better performance of such plants can be ascribed to the fact that they have passed through a more satisfactory rest period.

The most commonly grown strawberry varieties are Whiteheart and Laxton's Noble. Another variety which has shown up well in variety trials here is Leopold d'Tardive; this variety, however, requires adequate cross-pollination to set a payable crop.

Preparation and Choice of Soil.—The site chosen for strawberry production should be sheltered from prevailing winds, the soil should be level and irrigation water must be readily available throughout the summer. As regards soil, this fruit does best on a sandy loam which is rich in organic material, but can be grown on a wide range of soil types. The soil should be slightly on the acid side. The experience of growers in other countries has been that this crop does best on old grain, pasture, or recently cleared orchard land, but does not do well on land where vegetables, especially potatoes or tomatoes, have been grown for some time.

Land used for strawberry production should be thoroughly prepared before planting. Smother crops, such as grain, lupins, cowpeas, etc., should be ploughed in several times. The purposes of such green crops are twofold—first, to kill off weed growth, and secondly to build up organic reserves in the soil. The soil should, where pos-

..rately levelled to facilitate irrigation, and before the set, must be worked to a fine tilth.

..inimum dressing of 60 to 80 tons per morgen of well-rotted manure or compost should be incorporated in the soil before ..ating, while one month after planting a dressing of 200 lb. per ..orgen of a nitrogenous fertilizer should be applied around the plants.

General Cultural Practices.—In the Western Province, strawberries are generally planted in rows approximately 1 foot 6 inches apart, with plants 4 to 9 inches apart in the rows, this spacing depending on soil fertility. Planting takes place during the period May to end July, and such beds are then cropped during the summer. As a rule, beds are cropped for only one season, new plantings being laid down each year. It might be mentioned that this cultural system differs considerably from the methods employed in other countries with higher average yields per acre.

When planting, it is essential that the roots of the plants should not be allowed to dry out, and that they are well firmed with the soil. After setting, the crown of the plant should be just above soil level. If the crown is set too deep, or so shallow that the tops of the roots are exposed, then they will either die or else bear poorly. The importance of these seemingly simple operations cannot be stressed strongly enough, and they play a major role in ensuring the success of strawberry beds.

After planting, the field must be kept free from competitive weeds. When irrigation becomes necessary, the beds must be watered regularly. During hot spells it is often necessary to water at 3 to 4 day intervals, while for the greater part of the summer the beds should be watered once a week.

When the crop is off, the strawberry plant sends out runners which form new plants. The general practice in the Western Province is to neglect the beds when once the crop is off, and from January onwards the beds are under weeds. If such young plants are to be used for next year's plantings, this practice is to be condemned, as it leads to rapid degeneration of plants. Where the object is to produce young plants, every effort should be made to encourage the formation of strong, vigorous runners. This can be accomplished by keeping the beds in good condition, and by limiting plant production to two plants per runner.

In other countries the use of a mulch on strawberry beds is a common practice. A mulch of straw, pine-needles or some other suitable material is spread around the plant shortly before the berries start to ripen, thus conserving soil moisture, keeping berries clean, and lessening berry rot. This practice is, however, seldom employed in the Western Province.

Diseases and Pests.—There are a number of diseases and insect pests which attack the strawberry plant and fruit. In the Western Province the control of such maladies has generally been neglected, and higher yields would be obtained if more attention were paid to systematic control measures.

Brambles.

Of the various brambles tested out at this Institution, the most promising for cultivation in the Western Province are the Loganberry, the Lowberry, the Youngberry and the Boysenberry. These are all Dewberry crosses and originated in America. These brambles are capable of producing heavy crops, and thrive over a wide soil and climatic range. They have all been tested out for jam and jelly-making, for which they proved most satisfactory. In America they

are also used extensively as fresh fruit, for stewing and for the preparation of cool drinks, and in the flavouring of

General Cultural Practices.—Brambles do best in p sheltered from strong summer winds, while an adequate supp water for summer irrigation is a pre-requisite for success. Th berry fruits thrive on most well-drained soils which are rich in organic material. An annual application of 20 to 30 tons per acre of manure or compost should be given, while light dressings of fertilizer mixtures, high in nitrogen, give beneficial results when applied previous to blossomings.

Young berries on 4-wire trellis, blossoming for the first time.

Plants can easily be propagated by tip-layers, cuttings, root cuttings, leaf cuttings, etc., the method commonly used being that of tip-layering. The soil should be well prepared before planting, and organic material should be ploughed in. The recommended spacing for these brambles is 6 feet by 6 feet, and at planting time the roots must not be allowed to dry out, and must be well firmed in the planting hole. During the first summer the production of healthy, vigorous canes should be encouraged by regular irrigation and cultivation.

During the winter the young canes lose their leaves, and are then put up on some kind of a trellis. In America a cheap commercial method used is the stake system. Wooden stakes 7 to 8 feet long are driven 2 feet into the soil, 3 inches away from each plant. The canes are then wound spirally around each stake, and tied in three to four places with soft string. Another system which has given good results in this country is the four-wire trellis. The wires are spaced 3 feet, 4 feet, 5 feet and 6 feet above soil level, and are supported by wooden standards 24 feet apart. Sometimes barbed wire is used in place of steel wire, with the result that canes are held more firmly during windy weather. With any type of wire trellis the canes are held in position by weaving, and where necessary by tying with soft twine.

The fruit of these brambles starts ripening from the middle of November, depending on variety, and continues for each variety for

.om 6 to 12 weeks. It has been found that in hot locali ,nave a relatively low humidity, the fruit is cropped over a period than in areas having a higher humidity.

,mmediately the crop is off, all the old canes are cut off at ground ., removed from the trellis, and taken out of the field and burned. At this stage some of the young canes which are produced from the roots each year, will be about 6 feet in length, and on no account must any of these potential bearers be removed or damaged.

Diseases and Pests.—Three weeks before blossoming, the canes must be sprayed with lime sulphur, 1 in 15, for the control of anthracnose and soft scale.

The Cape Gooseberry.

The Cape gooseberry is a popular fruit for jam-making and can also be eaten fresh or used for stewing and pie-making. This fruit can be grown in most parts of the Western Province, and provided there is sufficient labour for harvesting, should be worth while going in for in places where there is a demand for it.

General Cultural Practices.—The Cape gooseberry prefers a sandy loam soil, and best results are obtained on virgin ground. Before planting, the soil should receive a liberal dressing of compost or stable manure. This fruit is propagated by seed. The seed is extracted from ripe fruit and sown in well-prepared seed beds during May or June. The young seedlings are transplanted from August to September. The seedlings are usually set out 6 feet by 3 feet, and immediately after planting, their roots should be firmed with the soil by watering, care being taken not to wet the leaves of the plant.

If the weather is dry and hot, the plants should be sheltered from the sun until such time as they have become well established. Planting usually takes place during the late afternoon when the heat is less intense.

During the summer months, the plantation should be irrigated and cultivated at regular intervals. Harvesting begins about April and extends to August or even later, picking being done at fortnightly intervals.

Influence of Climate upon Fruit Production:—

[Continued from page 381.

The pendulum is swinging back however, as the decrease in winter temperatures during 1940, 1941 and 1942 clearly shows. Crop production during the 1941-42 season was, on the whole, more satisfactory and the prospects for the 1942-43 season are, generally speaking, favourable.

A study of temperature fluctuations indicates that most probably the trend of winter temperatures for the next few years will be to decrease. If this proves to be the case, better years as regards fruit production await the fruit-grower.

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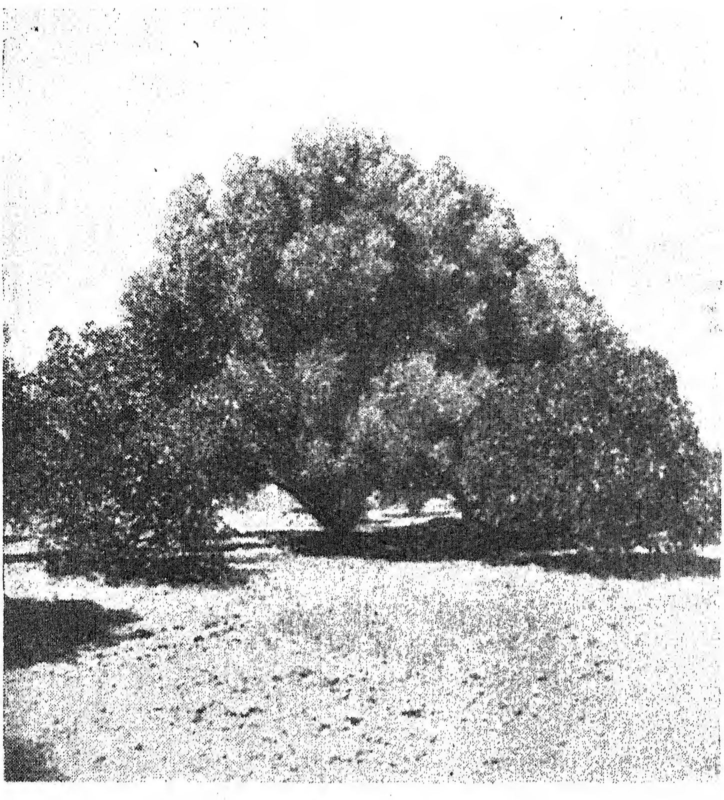
The Olive.

D. du Preez, Fruit Research Institute, Stellenbosch.

JUDGING from the number of enquiries made by farmers in connection with olive culture, it would appear that planting of this fruit is receiving considerable consideration. Since 1939 the price of olives has risen appreciably, and to-day the demand far exceeds the supply. Under such circumstances it is only natural that efforts will be made to satisfy the demand.



Olives between Fig Trees.

A good indication that the olive is at home in our coastal belt is that thousands of vigorous wild olive trees are found in this zone. There is, therefore, no reason why more olive trees should not be planted in that area. The tree itself is ornamental and olive oil is a valuable foodstuff for man and beast.

Suitable Soils.

Once the tree has become established, it is very resistant to drought and can be planted on soils where other crops would not prove an economic success. In vine-growing areas, olive trees can be planted on steep slopes where soil erosion would be encouraged by clean cultivation. It would be desirable to clear the soil around the trees without necessarily cultivating the whole area. Such odd corners of ground are to be found on many farms and could be planted to olive trees.

Varieties.

...es are grown primarily for the production of olive oil and ...sser extent for the fruit which is used for pickling purposes. ...ieties are classified under these two groups, but there are also ...me dual purpose varieties.

Pickling varieties are generally large-fruited with a low oil content, while those used for oil are, as a rule, smaller and contain a higher percentage of oil. Dual purpose varieties lie between these two groups as regards size and oil content. Farmers should concentrate on varieties which are suitable for oil production, and in this connection Leccino and Lucca, sometimes known as Razza, are satisfactory. A very popular variety grown in California is the *Mission* olive. The tree of this variety grows erect and is a good bearer. The fruit, which is of medium size, is suitable for both oil expressing and pickling purposes. Local observations have shown that this variety thrives and bears well and is, therefore, strongly recommended.

Sevillano, commonly known as Spanish Queen, is regarded as the best variety for the production of green olives for pickling. This variety is easily recognised by its very large fruit.

When ordering olive trees, the farmer should clearly state that only the varieties asked for should be supplied, since occasionally unsuitable varieties are substituted for those wanted.

Planting the Young Tree.

The olive tree is by nature very slow growing, but eventually develops into a large tree. The trees should be planted at least 30 feet by 30 feet apart, otherwise they will begin to crowd each other. This would result in the development of dead wood in places shaded from the rays of the sun.

A large hole should be made in which one or two bushels of well-rotted stable manure or compost are thoroughly mixed with the soil. Early planting during June or July is recommended so that the tree can be well established before the advent of warm weather. If the young tree shows any signs of drought, it should be watered until it starts growing. If the soil around the stem is liable to become too warm, as is the case with sandy soil, a straw or grass mulch should be placed around the stem. This covering will protect the stem of the tree, at soil level, against sunburn and will also conserve soil moisture. It is well worth the trouble to ensure that the young tree becomes well established, because if this is done, it will not require much attention later on.

Pruning.

After the young tree has been planted, it should be cut back to healthy buds at about knee-height. Should the tree have side-shoots, select four or five of the strongest and top them to the required height. It is very important to plant straight, sturdy trees, in which case it is improbable that there will be any side-shoots low down on the stem.

After one or two years, depending on tree growth, four to six branches which are healthy and well placed around the stem, should be retained to form the future frame-work of the tree, the rest of the branches being removed. Subsequent pruning is light, the object being to prevent the tree from becoming too dense. If this happens the inside twigs will die-off. The fruit is borne on young wood, the annual production of which must, therefore, be encouraged.

The wild olive or "Olienhoutboom" is raised from seed, then grafted or budded with the required variety. Hard wood cuttings ½-inch to 1-inch thick and 10 inches to 12 inches long can be planted and will root within one or two years. With this method selfrooted varieties can be produced, thus eliminating grafting and budding. There is a belief that trees propagated by the latter method take longer to come into bearing. It should be borne in mind, however, that the olive tree is a very slow growing tree and takes approximately ten years to come into full bearing. Consequently, time and patience are necessary for the propagation of olive trees.

If farmers are able to procure seedlings cheaply, it will be worth their while to propagate their own trees, provided conditions are suitable. Seedlings of approximately the thickness of a finger can be collected, planted in a nursery and grafted or budded with the best varieties when they have become well established. It should be borne in mind, however, that it takes from three to four years to produce a strong, healthy tree. Another possibility is to lay out a grove of wild trees and to topwork them later on. A drawback of this system is that the orchard will be very uneven, as it is impossible to eliminate weak trees. Furthermore, filler trees planted in the place of those which fail to take (the percentage will probably be high) will be at least a year behind hand.

Top-working of Old Wild Olive Trees.

On many farms numbers of wild olive trees are to be found, growing along river banks or on stony outcrops. Such wild olives when topworked successfully, will develop into fine beautiful trees, and will later become a source of income. Many of the picturesque olive trees found on the slopes of the Paarl Mountain were gradually topworked and are to-day yielding satisfactory and profitable crops.

The wild tree is sawn off at a height of about four feet and is then bark-grafted. If the tree has many scaffold branches these should be thinned out to five or six well placed limbs. This operation should be performed when the bark slips readily as the lower point of the scion is pushed underneath the bark. This system has been practised with success at Paarl. When an old and vigorous olive tree is cut down, many young suckers will sprout from the stem and most of them will have to be removed from time to time. Well-placed shoots which are not removed, can be budded later on in order to take the place of any grafts which might have failed.

Recommendations.

The possibilities for planting olive trees on a limited scale for the production of oil are good. In the vinegrowing districts of the winter-rainfall area, such olive groves should be established on soils where it would not be economical to grow other crops. The conversion of wild olive trees into profitable trees, should be a gradual process.

A well-equipped oil-extraction plant is already in existence so that the farmer now has a market for his product.

Farmers should not lose sight of the fact, however, that under normal conditions olive products can be imported very cheaply. Consequently, the laying out of groves and the topworking of wild trees should be done as economically as possible.

The tree is ornamental and can, therefore, be planted to beautify the landscape and also to provide shelter for animals. Once the tree has become well established the cost of upkeep is so small that the yields should prove remunerative.

Guava Culture:—

[Continued from page 388.

Varieties.

Certain farmers have been propagating some of the best varieties in their orchards vegetatively and in this way a few well-known varieties have come into existence. The most important of these varieties is the "Fan" or "Basson" as it is sometimes called. This variety is acknowledged by farmers as being the best guava in respect of bearing, keeping and canning qualities. It might be mentioned that a guava tree bearing seedless fruit originated in Klein Drakenstein. Should this tree possess the characteristics of heavy bearing and fruit of good quality, it might prove of great value, especially for canning.

A start has been made at this Institute with the selection of varieties, and farmers are called upon to co-operate with us in this matter by forwarding samples of fruit of their outstanding heavy bearing trees and later some propagating material of those trees. When about eight to ten suitable guava varieties are available, future research on problems which may crop up could be carried out more effectively. The canning quality of these different varieties will be thoroughly tested out. The selection of standard varieties is thus essential for the future welfare of the guava industry.

Notwithstanding the great demand for guavas at the present time, farmers are strongly recommended to plant guava trees only on deep, rich soils under irrigation in suitable areas. Furthermore, the importance of planting only vegetatively raised trees of the few known varieties in preference to seedlings, cannot be stressed too strongly.

Incidently, mention can here be made of an article recently written by Dr. Herbert John Webber,[2] in which he calls upon some farmers in California to plant more guavas. It has also been found there that certain varieties have a very high vitamin content. Dr. Webber, who started this work 25 years ago, mentions six varieties which have already been selected and used in these experiments.

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[2] "Extending Guava Production to California", by Herbert John Webber. Proceedings of the American Society for Horticultural Science, Vol 41, 1942, pp. 228-233.

Popular Bulletins.

(1) Calf Rearing—Bulletin No. 224. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

(2) The Export of Fresh Grapes from the Union of South Africa during the Ten-year period, 1930-39—Bulletin No. 225. Price 6d. Obtainable from the Chief, Division of Horticulture, Pretoria.

(3) Soft Cheese as a Food—Bulletin No. 229. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Grape Varieties for the Local M...

M. S. le Roux, Fruit Research Institute, Stellenbosch.

AN essential characteristic of a prosperous industry is plasticity and the ability to adapt itself to the exigencies of changing conditions. The deciduous fruit export market has temporarily vanished, and the industry has to dispose of its produce through an inland marketing system which up to now has been almost totally neglected.

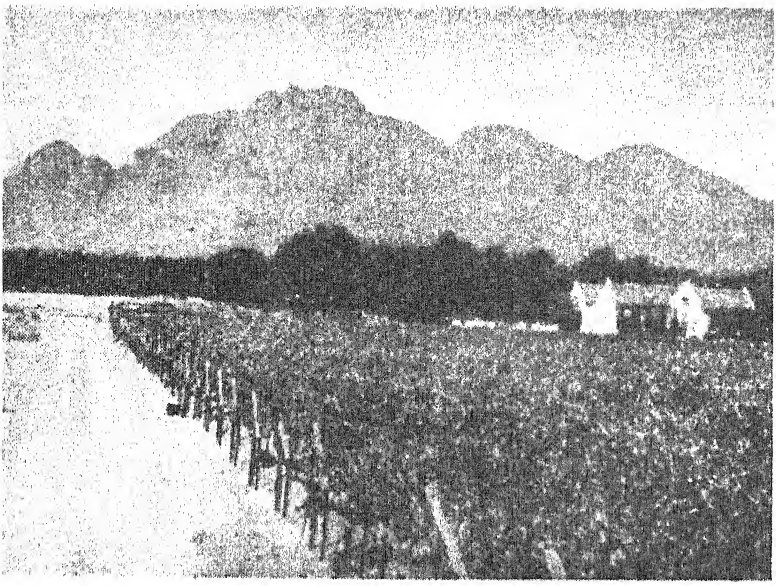


Fig. 1.—Experimental vineyards, Groot Drakenstein.

Requirements of Consumer.

The major problem in connection with local marketing is the unsatisfactory state of our system of distribution. Adaptation to a new market necessitates primarily an intensive study of the requirements and peculiarities of the consumer who supports that particular market. A considerable portion of our buying public lack fruit consciousness. Another important fact which constitutes an almost complete departure from former requirements is that grapes in South Africa will have to be sold mainly on the basis of the palatable quantities of the fruit. A noteworthy fact is that the majority of South African consumers have a predilection for grapes with a muscat flavour. These preferences have to be taken advantage of. What a pity that so many tons of luscious Hanepoot grapes still go through the wine-press! An additional advantage for the local market would be a higher sugar content, whereas the decorative qualities, such as size and uniformity of berry, etc., although desirable, are of secondary importance.

Re-overtation is of great importance in connection with the varieties which are grown. Owing to the temporary nature of the set-back in our former markets, which will probably be restored in

..or
...na ... greater measure in future, the general replacement of
...ger ... which at present are less suitable, cannot be advocated
...es ...ttention should, however, be paid to a few promising varieties
...ss...n are discussed below. These varieties, some of which possess
...et... other outstanding characteristics, especially for local markets, are
...ne still more or less in the experimental stage. In some cases they are
to be found only in the experimental plots of our Institute under specific environmental conditions. Interested growers are recommended to start off on a smale scale.

Fig. 2.—"Queen of the Vineyard" on overhead trellis.

Promising Varieties.

(1) *Queen of the Vineyard.*—A few farmers, especially in the Paarl area, are already acquainted with this new variety, which was imported from Central Europe about seven years ago. It constitutes a cross between two lesser-known varieties named Queen Elizabeth and Pearl of Csaba. As can be seen from the accompanying illustrations, it closely resembles Waltham Cross. Queen of the Vineyard can be described as a grape with one important shortcoming, but several outstanding qualities which cannot be denied. The outstanding characteristics in favour of this grape is its earliness, its delicate muscat flavour, and its very attractive amber colour. Its main disadvantage is an inherent tendency of the berries to split when exposed to rain at a late stage. Nevertheless, there exists a possibility that this tendency could to some extent be reduced by pre-thinning and judicious irrigation, a matter which, however, has still to be confirmed. Queen of the Vineyard promises to be best suited to the earlier localities, such as Paarl. During 1941, in the latter region, a portion of the crop was ready for the Christmas market, and is, therefore, several weeks earlier than Waltham Cross. The rest of the crop, however, was almost entirely destroyed by a rainfall of ·3 inch on the 13th January 1942. Regarding its other characteristics, this grape closely resembles Waltham Cross

It grows well and bears excellent crops with medium-low . The bunches are better shaped than those of Waltham Cross, berries are large and oval. Shot berries sometimes occur, evidently to a lessor extent than in Waltham Cross. Typical of variety is a fairly big second crop. A five-weeks cold-storage test proved its keeping qualities to be excellent. It is, therefore, clear that Queen of the Vineyard, in spite of its tendency to rupture, merits consideration for both export and inland marketing purposes. For the present, and until further information is obtained, the

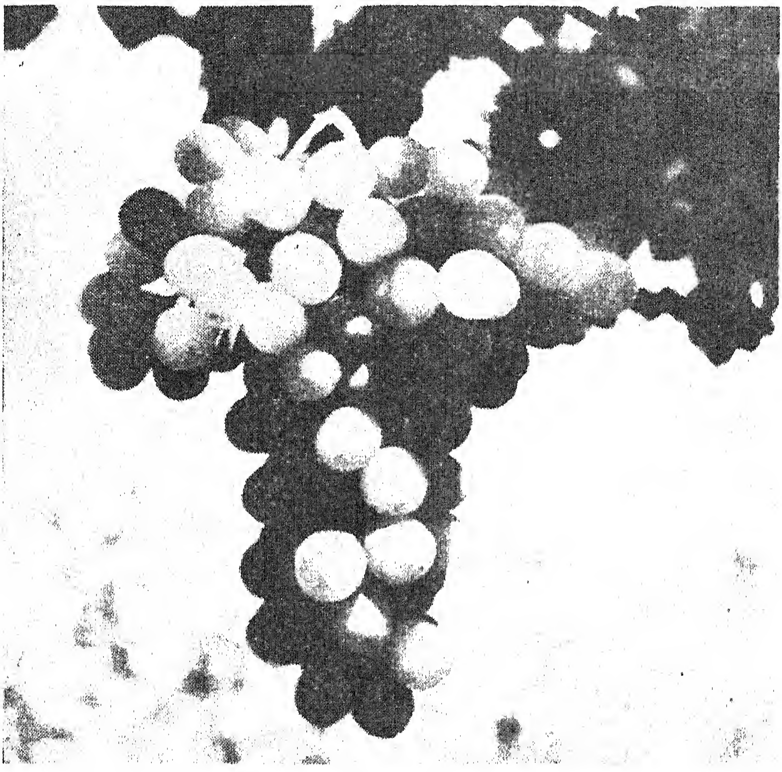


Fig. 3.—" Queen of the Vineyard " bunch.

cultivation of this variety should be judiciously undertaken, but it can, nevertheless, be recommended as one with distinct possibilities under suitable conditions.

(2) *Pearl of Csaba.*—This is another variety which merits attention, and has been mentioned above as one of the parents of Queen of the Vineyard. This delicate white grape is by far the earliest variety known in this country. At the Paarl Viticultural Station, which is not by any means the earliest farm in this area, the whole crop in 1940 had been gathered before the 9th of December! As has been stated, however, Pearl of Csaba is very delicate and small-berried, with small bunches, and in general resembles the typical wine varieties. It is, therefore, undoubtedly unsuited for marketing at a distance. Apart from its outstanding earliness, this variety also possesses a very pleasant muscat flavour. It is evident that Pearl of Csaba will find a very ready market, especially at our sea-

[illegible] gy resorts, if anybody cares to take the trouble to grow and [illegible] wh[illegible] for that purpose. If Pearl of Csaba is to produce a reason[illegible] [illegible]crop, it should be pruned fairly long.

(3) *Pirovano No. 15.*—This early variety—a black grape—was [illegible]ored by an Italian named Pirovano, from Bellino, and the better-known early Madeleine Angevine. It resembles Black Prince both in appearance and taste. Again the difference is that it is considerably earlier. During 1940 at Paarl it bore a perfectly sweet bunch by the beginning of December. During the past season the whole crop was past the correct stage for picking by the 23rd of December. On the latter date, Black Prince in the vicinity had barely started to turn colour. Typical of this variety are tiny freckle-like spots on the berry resembling rust flecks on grain stalks, but in no way detracting from its appearance. The vine grows and bears well with short pruning. Favourable reports concerning its marketing qualities were received from the Johannesburg market a few years ago.

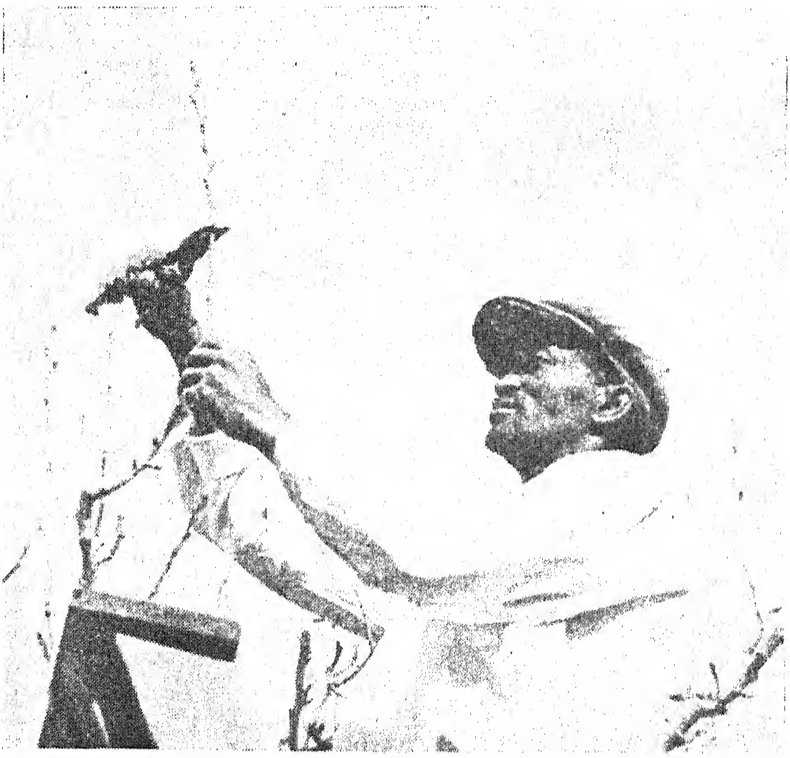
(4) *Ferdinand de Lesseps and Muscat Hambro.*—Two further varieties which should be mentioned here, although already fairly well-known are *Ferdinand de Lesseps* and *Muscat Hambro.* The former is well-known on account of its typical pineapple flavour. It is an early white grape which bears well when long-pruned. Unfortunately it lacks berry size, but the fruit carries fairly well. The vine itself is strong, healthy and easy to grow. *Muscat Hambro*, on the other hand, differs from the previous four varieties in that it is not an early grape. It is, however, a good deal earlier than Hanepoot for instance. Of special interest is its outstandingly pleasant muscat flavour—a feature not commonly found in a black grape. Muscat Hambro bears well when spur-pruned, but its bunches are often straggly and shapeless. This variety is evidently more at home in the Karroo area.

In conclusion, it is necessary to repeat that the five promising varieties which have been described above and especially Queen of the Vineyard, Pearl of Csaba and Pirovano No. 15, are still in the experimental stage. Each, however, possesses such outstanding qualities which make them particularly suitable for the local markets, that they should give good returns if grown and marketed in the proper way.

Pruning and Thinning of Decid[uous] Fruit Trees.

M. W. Black, Fruit Research Institute, Stellenbosch.

WHEREVER deciduous fruit trees are grown, pruning forms an essential part of orchard management. It is an old established practice, rooted in the traditions of horticulture, and very few growers to-day would venture to question its manifold advantages. Yet the position in the Western Province to-day is that pruning has in far too many cases become a sadly neglected practice. Since the outbreak of war, the cessation of exports and the shortage of farm



Pruning Bon Chretien Pears.
[Photo: R. M. Nicholson.

labour have caused the position to deteriorate still further. In fact, it is quite a common sight to-day to see orchards or trees that have received but scant attention from the pruner.

Many growers wrongly regard pruning as mere routine work which does not require the same specialized knowledge and personal interest as other orchard operations such as, e.g., fertilizing or spraying. It should, however, be borne in mind that pruning is perhaps the most important orchard treatment influencing the performance of the tree in general, and that during the winter months it should always be considered as the most urgent work on the farm.

... grower is unfortunate enough not to have experienced ...at his disposal, he should himself undertake to train the more ...igent of his labourers to do the work. Any boy with a certain ...ount of common sense could be made to do a good job of pruning, ...ovided the necessary supervision is exercised.

Space does not allow a detailed discussion of the whole subject of pruning, but two very important results of pruning will be dealt with here in brief, viz., tree vigour and fruit quality.

Tree Vigour.

By vigour is simply meant the amount of new growth that a tree puts on annually; growth here includes especially the production of shoots, spurs, leaves, roots and other vegetative parts of the tree. The vigour of a tree is determined mainly by its environment, e.g., climate, soil, moisture, etc., by the rootstock and also by its age.

Young trees are more vigorous than mature trees. Once the tree is in full bearing and the roots have occupied most of the soil space, vigour tends to decrease as a result of the exhausting effects of cropping. This decline in the vigour of bearing trees is particularly evident in the winter-rainfall area where conditions generally favour a heavy set of fruit, but are relatively less favourable for vegetative growth, due to the dry hot summer climate.

The initial decline in vigour of a tree is generally associated with an increase in yield, but at a subsequent stage when vigour reaches a low level, fruit production also becomes impaired and yields will steadily decrease or become irregular; moreover, fruit growth is checked, leading to inferior quality. It is essential, therefore, that the vigour of the tree should be maintained at all costs. Although cultural practices such as fertilizing and irrigation are of great importance in keeping the tree in a state of vigour, the crux of the matter lies in judicious pruning.

Pruning prevents the tree from forming an excessive crop, thus allowing more moisture, nutrients and reserve materials for vegetative growth. Pruning also results in a better exposure of the growing parts to sunlight—so necessary for the normal functioning of the leaves.

A well pruned tree should always show a correct balance between yield and vigour. To obtain this condition, the grower should study his trees carefully and treat each variety, each orchard and where possible, each individual tree according to its own merits. For instance, a full-bearing Ohenimuri apple tree showing a profusion of spurs with very little or no shoot growth, should be heavily pruned and many of the spurs thinned out, whereas a vigorous tree of the same type could merely be lightly thinned out without any spur pruning. A peach tree of which the fruiting laterals consist mostly of short stubby growths, should be hard pruned, so as to obtain a more vigorous type of bearer; the short laterals should be heavily thinned out and the leader branches cut well back to suitable laterals.

The degree and type of pruning varies thus according to the vigour requirements of the tree. A tree of bearing age should show at least an average length of new shoot growth of about 9-12 inches. The presence of a healthy, well distributed shoot growth is indicative of sound growing conditions in the tree in general. Very rarely instances occur where vigour may be excessive and yield as a result poor. Here very little pruning is required and it is particularly important that on cutting back (topping) should be done. In the

western Cape Province, however, our main problem is lac[illegible] and the general tendency is rather to underprune than to o[illegible]

The question of maintaining tree vigour by means of pru[illegible] of extreme importance to-day, considering the shortage of fertili[illegible] especially nitrogenous fertilizers. Many growers will probably [illegible] forced to apply less fertilizers to their orchards and this wil[illegible] undoubtedly lead to a steady decline in the vigour of the trees. The only practical and effective way of counter-balancing this unfortunate state of affairs would be by a rational system of pruning. Therefore, the necessity for pruning cannot be stressed too strongly to-day.

Fruit Quality.

The promotion of quality in the crop is undoubtedly the most important advantage of pruning, as the quality of the fruit determines its sale value.

By quality is meant a variety of desirable fruit properties, the more important of which are size, colour, soundness, general appearance, texture, juiciness, flavour and storage life. All these properties are influenced mainly by favourable climatic, nutritional and moisture conditions during the growing season of the fruit. Although climatic factors are mostly beyond the control of the grower, pruning, by providing more sunlight for fruit and leaves, will promote colour development of the fruit and creates favourable conditions for the normal functioning of the leaves. As the fruiting wood will be better spaced and spraying facilitated, the fruit will also be sounder and relatively free of wind blemishes.

But pruning is essentially a regulatory measure—the size of the crop is limited so as to provide more moisture and nutrients for each individual fruit. For its normal development to maturity, the fruit is dependent on the carbohydrates manufactured in the leaves, as well as on the mineral matter in the soil. Hence, a large sound leaf surface is required on the tree to ensure good fruit quality. By pruning and thinning, the ratio of leaves to fruit is increased and so improved size and quality is attained.

Perhaps the most striking effect of pruning is its influence on the size of fruit, which is rather important as small fruit is uneconomical to grow and is regarded as undesirable by the trade. Grading standards to-day are also largely based on a minimum size. To illustrate the effect of pruning on the grade of fruit, mention could be made of a small scale pruning experiment on Santa Rosa plums carried out on the University Farm, Stellenbosch. During a five-year period, the average unpruned tree produced about double the crop of the average pruned tree, but the general grade of fruit was very much inferior, as the following figures show:—

Percentage of crop in different size grades.

Diameter of Fruit.	Unpruned.	Pruned.
	Percentage.	Percentage.
Over $1\frac{7}{8}$ inch (suitable for single layer pack)...............	6·8	30
$1\frac{3}{4}$ inch to $1\frac{7}{8}$ inch..................................	16·8	34·5
$1\frac{5}{8}$ inch to $1\frac{3}{4}$ inch..................................	19·6	20·8
$1\frac{1}{2}$ inch to $1\frac{5}{8}$ inch..................................	11·2	7·2
Below $1\frac{1}{2}$ inch (not allowed for packing by Board).........	45·6	7·5

It might also be stated here that the average size of the fruit of the unpruned trees has steadily decreased during the past few years, so much so, that last year more than 90 per cent. of the crop was

... x 1½ in. diameter, a considerable proportion falling under ... meter. This means that for all practical purposes the crop ... thless.

That continued neglect to prune may not only lead to a reduction in grade but also in size of crop, is evident from the following experiment carried out at Wellington on a block of old neglected Royal apricot trees. These trees had been left unpruned by the owner for a number of years and, consequently, were in a very poor state of vigour, yields having been low for some years. Some of the trees were left unpruned, others were heavily pruned, large amounts of old fruiting wood especially being thinned out. The pruned trees showed a marked growth response the first year and also gave a slight increase in crop. In the second year there was an 80 per cent. increase in crop over the unpruned trees, due to the large number of new fruiting shoots and spurs which had formed the previous summer. In addition, the pruned trees produced during the two years 13 per cent. more first grade fruit (dried fruit standards). The difference in crop and grade resulted in a net gain of 3s. per tree in favour of pruning.

It should be borne in mind that apart from increasing the size of fruit, pruning enhances general appearance and attractiveness—a pre-requisite to-day for high quality fruit.

Thinning of Fruit.

The hand thinning of the immature crop is a very necessary supplementary measure to pruning. In fact, it could be regarded as part of the regular pruning practice.

The object of thinning is also to reduce the crop to an extent compatible with good average quality. Pruning alone is not always an adequate method of regulating the crop. If, after fruit setting, the crop still appears excessive, further reduction by hand is necessary. Although very important as an adjunct to pruning, thinning can never wholly replace pruning. For one thing, thinning is much more expensive and, moreover, the less the amount of pruning, the greater will be the cost of thinning. Furthermore, at the time of thinning (usually about November) an unpruned tree will already have exhausted a considerable part of its reserves on a superfluous amount of bloom and fruit setting; tree vigour will, as a result, suffer and the belated crop reduction would thus only be of limited value.

Thinning should thus begin with the pruning shears and, where necessary, be carried further by picking off superfluous fruit after the final set when the last signs of natural shedding are over. Thinning is especially important with plums and peaches, but is also necessary with apples and pears where the set has been good. With the latter fruits, thinning out of the dense fruit clusters is also an aid in the control of codling moth.

Many growers find it difficult to believe in the economic advantages of thinning, considering the high labour costs involved. It should be borne in mind, however, that the crop on an unthinned tree would consist mostly of small fruit which would considerably increase the costs of picking, packing and marketing, compared with the same weight of fruit of a thinned tree; moreover, in the past there has been little demand for undersized fruit.

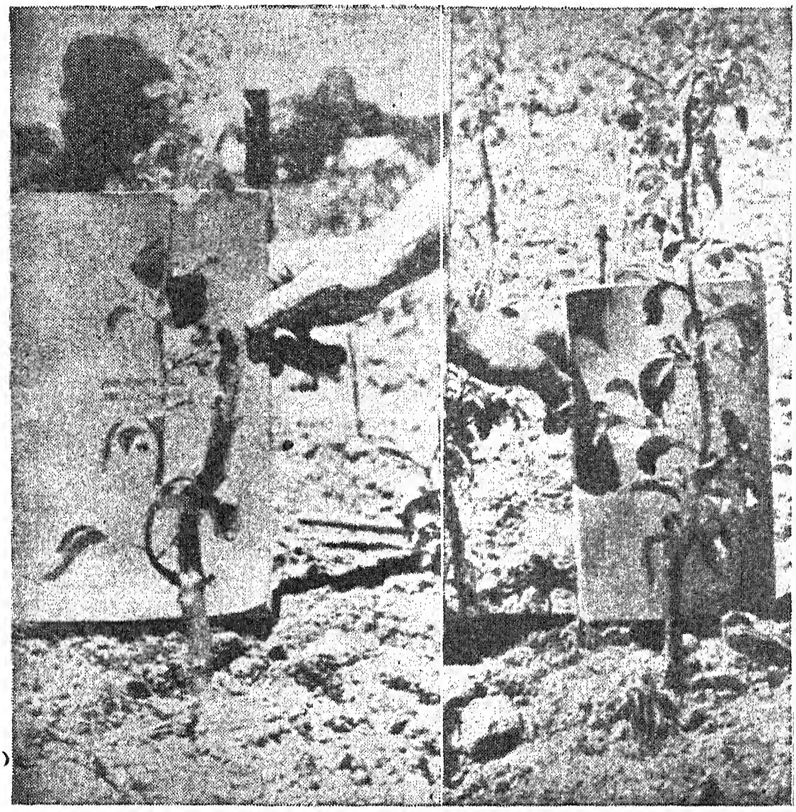
Much will depend, of course, on the relative prices for high and low grade fruit, because it is evident that the unthinned tree will

[Continued on page 412

The Budding of Deciduous Trees.

A. F. de Wet, Fruit Research Institute, Stellenbosch.

THE practice of propagating certain plants by budding and grafting has been well known for ages. Basic principles to consider for success are affinity between plants, contact of live cambial layers, correct season and procedure of practice.



A.—Budded Pear with Stub. B.—Ditto without Stub.

Though many methods of budding and grafting exist, the underlying principles are the same and whether trees are being propagated for sale or personal use, the most economic methods based upon sound scientific principles should be practised. In this article the reader will find a brief description of shield budding in general with references to practices mentioned in literature compared with conclusions based upon local experimental results which it is hoped will be of advantage to all concerned.

Procedure of Budding in General.

When budding deciduous fruit trees, the general procedure is to insert and tie-in the buds in late summer, remove the tying material after ten days or longer and leave the tree till spring. In early spring the stock tree is headed back to about 3 to 6 inches

...ud. That portion of the stock from where it was headed ...n to the point where the bud was inserted, is generally ... as the stub. With growth initiation all growth from the ... is regularly removed, leaving the shoot developing from the ...erted bud only. This bud shoot is then tied to the stub for ...traightness and protection against wind. When the bud shoot is well developed, usually about December, the stub is removed by making a smooth sloping cut behind the bud shoot, this wound is painted over and the tree is ready for planting out in the fall. The above is a very brief description of the propagation of fruit trees by budding. A survey of nursery practices and horticultural publications will at once show that much divergence of opinion exists with regard to detail in technique and procedure in the western Cape Province, as well as overseas

The most common of these differences are:—

(*a*) position of the horizontal cut;
(*b*) tying materials used;
(*c*) bit of wood in the bud shield; and
(*d*) the extent of heading back in spring.

(*a*) *Position of Horizontal Cut.*—In shield budding a vertical cut 1 to 1½ inches long is made just through the bark of the stock at the point considered best suited for the insertion of the bud, followed by a similarly made incision horizontally across it. The question now is whether the horizontal cut should be made at the apical or base end of the vertical one. These are commonly referred to as the upright "t" (T) and inverted "t" (⊥) incision.

Some writers and nurserymen occasionally refer to instances where one method is preferable to the other, yet all appear to be rather vague and in general practice advocates of the one method appear to be as successful as those of the other. Experiments carried out at Stellenbosch with pears in 1936 failed to show any difference in percentage take or grade of maiden tree.

Efficiency and speed, which can be acquired by practice only, are the two main standards a budder is judged by. Since the position of the horizontal cut appears to be of so little importance, it should be decided by the budder's experience.

The slipping of a bud into position will be facilitated if the frontal end of the shield is evenly tapered. That end of the bud shield which is cut when the knife is inserted can be cut to taper far more evenly than the end where the knife is withdrawn. An interesting point to remember, therefore, is to cut the bud shield from the basal side of the bud on the budstick when making the upright "t", and from the terminal side when making the inverted "t" incision.

(*b*) *Tying Material.*—Everyone concerned with budding agrees that after its insertion the bud has to be tied in to keep it in position, press the cambial layers in firm contact and prevent drying out. In practice one operator usually does the budding and another the tying immediately after him. Tying is done tight enough to conform to the above, but should not be so tight as to interfere with the flow of sap, ringbark or constrict the tree. Any thin, soft, elastic and pliable material which is easy to handle and which will put an even pressure on the tree, can be used for the purpose. An ideal tying material would be one which would best serve the purposes mentioned, be the cheapest and cost the least in labour to apply. Naturally, no ideal tying material exists, while some will be preferable to others for certain purposes and are selected according to

their relative suitability in practice. So, for example, w[illegible] strips will allow less evaporation, while the elasticity o[illegible] strips, which are being used extensively in America, will not constrict the tree if the ties are left on long.

Rubber strips and raffia were compared in a budding experiment with pears at Stellenbosch in 1936. In either case over 90 per cent. of the buds took and there was no difference in the development of the trees. Similarly, overseas experiments have failed to prove the one superior to the other in general and it seems that the economic aspect should decide what to use. Costs were not compared in the experiment at Stellenbosch, mentioned above, but rubber strips would be hardly procurable to-day, while raffia is obtainable at a reasonable price. Furthermore, since nursery labour is accustomed to the handling of raffia, it is at present bound to receive priority as a tying material for budded deciduous trees in western Cape Province nurseries.

(*c*) *Bit of Wood in the Bud Shield.*—The question which arises here is whether the small bit of wood inside the bark forming the shield, which is severed from the budstick with the cutting of the bud, should be retained or removed before the bud is slipped into position under the bark of the stock.

According to the literature referred to, the general practice in England and Europe appears to be to remove it, but not in America. In the western Cape Province most nurserymen seem to retain the wood when budding deciduous trees, but some remove it with citrus, and all appear to be equally successful. Small-scale experiments carried out at Stellenbosch with pears and plums have also failed to produce significantly different results.

Cambial contact between stock and bud is essential for success and removal of the chip of wood will increase the area of exposed cambium, while the bud shield will also fit better under the bark, especially if the stocks are thin. As against these advantages, it should be borne in mind that the bud is easily damaged with the removal of the wood, while the larger exposed area of cambium will naturally promote loss of moisture. These factors for and against either method seem to eliminate each other in practice. This explains why both are being practised with equal success. Since one method has not yet been proved superior to the other, the choice of method might safely be left to the operator unless differences are to be found in a different field.

To the experienced, the time required for removing this bit of wood is very short, yet it distinctly adds work to the procedure of preparing a bud for insertion. If this time, short though it might be, is multiplied by 2,000, the least number of trees an experienced budder should bud in a day, it would amount to a fair proportion of a working day, and thus be an added expense in the production of budded trees.

The chip of wood stiffens the bud shield slightly and it can be pushed under the bark of the stock more easily.

Possible exceptions might exist, but since the retention of the chip of wood appears to have certain general advantages and has not been proved detrimental to tree production, the practice of removing it should be abandoned.

(*d*) *Extent of Heading Back.*—Generally the budded tree is headed back to 3-6 inches above the bud before growth starts in spring. One reason given for cutting a stub is that the bud might

with closer cutting, but the main advantages attributed to it: that the shoot developing from the inserted bud can be tied to the stub to make it grow straight and to protect it from being blown off.

A series of budding experiments was carried out at Stellenbosch with pears and plums during 1936 and 1937 and in a private nursery in the Drakenstein Valley with apples, pears, peaches, plums, apricots and cherries during 1940 and 1941. In these experiments trees that were cut to stubs in the usual way were compared with others that were cut back level with the bud and the wounds covered with wax. Maiden trees produced by either method did not differ much, yet the general tendencies with regard to percentage bud take and grade were in favour of those without stubs.

A very important point very strikingly noticeable with these experiments was that the buds on stocks headed back hard pushed earlier and more uniformly than on those with 3-inch stubs. Experienced nurserymen will realize the exceptional advantages attached to early and uniform pushing of buds followed by even and accelerated growth during spring.

During the 1941-42 season, the time spent in second season care on trees budded in February 1941, was recorded. Records were kept of 310 trees of each treatment and revealed the very striking fact that the time spent in second season care of trees headed hard back was only one-third of that spent on stubbed trees. Some might consider these results interesting, but wish to know more about wind damage and the straightness of the trees. Both localities were these experiments were carried out are known to be badly subject to south-easterly winds during summer, yet the varieties tested did not differ in this respect with either treatment. For tree straightness the reader is referred to the figures and the fact that this new method is to a large extent being adopted in the commercial nursery where the experiments were carried out during 1940 and 1941.

Heading back hard can definitely be recommended, yet it should be borne in mind that all varieties have not yet been tested and exceptions might exist. So, for example, it is difficult to produce a straight tree with the Royal Apricot by either way, and it is suggested that nurserymen consider spending on staking what can be saved by cutting back hard.

This article should be regarded merely as a summary of a scientific report which is being prepared for publication. Meanwhile, those considering the application of certain practices advocated are advised to communicate with the author.

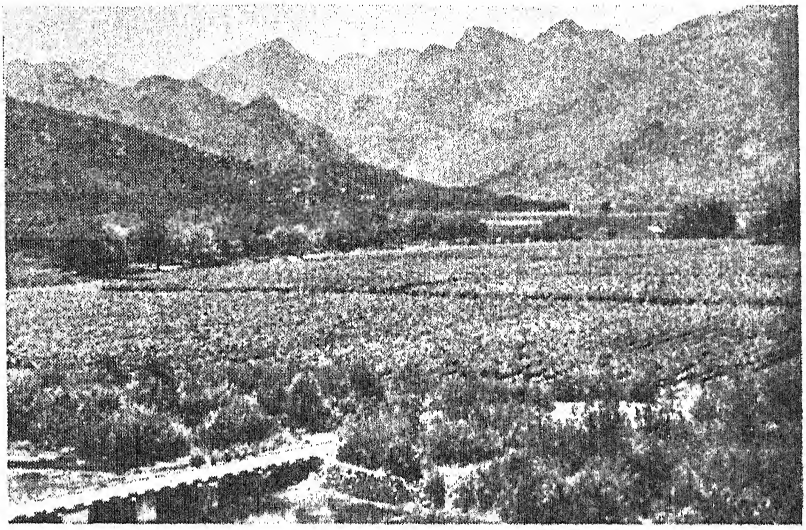
Sale of Karakul Sheep.

34. *Pure-bred Karakul sheep* (17 Rams and 17 Ewes) registered in the S.A. Stud Book, will be sold by Public Auction at the Grootfontein College of Agriculture, Middelburg, Cape, on the *23rd of June* 1943, at 10 a.m.

The Selection of Orchard

P. Daneel, Fruit Research Institute, Stellenbosch.

APART from climatic influences, soils must possess ce inherent physical and chemical properties for the succes. cultivation of perennial crops, like fruit trees and vines. Of thes aeration, structure, retentive power in relation to moisture and plant food, and general fertility are among the most important.



Vines on a well-chosen soil.

In the case of annual crops, cultivation can be adapted to the most suitable time of the year, when moisture conditions particularly are optimal. The fruit tree, on the other hand, is subjected to changing climatic and soil conditions throughout the year, and in the western Cape Province particularly, it must mature its crop during the driest period of the year.

Although most plants require uniform conditions of soil moisture, etc., throughout the growing period, they can adapt themselves to great variations in soil conditions. The main reason for this is the ability of fruit trees and vines to extend their roots over considerable distances. The most important soil characteristics, therefore, are those which promote root development.

Soil Depth and Aeration.

Although plants vary greatly in regard to their root system, some being deep-rooted and others shallow-rooted, it is generally accepted that roots penetrate deeper into the subsoil in arid than in humid regions.

Of the many factors which influence root penetration compactness, oxygen, water and plant-food content are among the most important.

The depth of the soil is usually limited by the presence of impenetrable layers in the sub-soil and by superficial water tables during periods of active growth. Although such layers are usually the result of the processes of soil weathering, they can be created

1½ in., ...eter. ...by always cultivating to the same depth. Whatever the ...chless. their formation, it is the duty of every grower to know ...that soil conditions in his orchards and to remove them by delving, ...tion ...her cultural operations, and thus encourage maximum root ...elopment.

A high water table or poor drainage is the result of ineffective sub-soiling, and the absence of the necessary provision for the removal of surface water. Roots cannot survive in the absence of oxygen, and if sub-soil water is allowed to displace the air from the soil, the tree invariably succumbs. Waterlogging of orchards is a frequent occurrence in western Cape Province orchards in spring, and although the tree may not necessarily die, its cropping power is invariably permanently affected. The well-known manifestation, known as "sour-sap", is the result of firmentation in the roots in the absence of air.

Although fruit-tree soils should be as deep as possible, cases are not unknown where orchards thrive reasonably well even on very shallow soils. No plant can be expected to survive for 15 or 20 years and bear normal crops if the root zone is inadequate. It would be unwise to plant fruit trees on soils so shallow that sudden changes from too dry to too wet cannot be controlled by normal cultural practices.

Soil Fertility.

Although it is possible to increase the natural fertility of a soil by artificial means, such efforts are usually wasted unless the soil possesses a certain inherent plant-food reserve. A moderately fertile soil is regarded as one which is neither too acid nor too alkaline, and which has an available potash and phosphate content of at least 0·01 per cent. The nitrogen content depends on the quantity and digestibility of the organic matter, and adequate quantities of soil-organic reserves are therefore essential.

The following tables indicates the quantities of plant food (in terms of known fertilizers) annually absorbed by the tree, and removed in the crop.

Absorbed by tree, in lb. per morgen.

	Ammonium Sulphate.	Super-phosphate.	Potassium Sulphate.
Apples	515	140	220
Pears	300	70	132
Peaches	750	180	288
Plums	300	90	152

Removed by crop, in lb. per morgen.

	Ammonium Sulphate.	Super-phosphate.	Potassium Sulphate.
Apples and Pears	150–200	50–70	90–110
Peaches and Plums	200–350	90	150–170
Grapes	150	50	110

It is obvious that unless this is replaced by adequate soil management, ultimate soil depletion is bound to ensue.

Western Cape Province Fruit Soils.

The fruit soils of the western Cape Province can be : into the following main groups:—

(1) *Sandy soils*, which have been largely formed from the T. Mountain and Bokkeveld sandstones. Although they vary from are to area they are, with few exceptions, unsuitable for fruit production. Their low plant-food content, low retentiveness and generally poor physical condition make their cultivation a highly doubtful undertaking. Pot-clay sub-soils which are a normal characteristic of this type invariably result in high water tables, poor drainage and a limited root zone.

(2) *Loam and sandy loam soils*, which have been formed from the Bokkeveld and Malmesbury shales. These constitute the predominated types on which fruit is cultivated, and vary considerably from area to area, depending on conditions of weathering. In Elgin they are gravelly, in Ceres very fine and clayey, while in Somerset West, Stellenbosch, Drakenstein and Wellington, their chief characteristic is their shallowness. Their absorptive capacity is high and general fertility fair, notwithstanding a low humus and nitrogen content.

On slopes and other localities where weathering or accumulation has resulted in a fair depth of soil, good root development and normal orchards are usually found. These soils are not subject to the high water tables found in the sandy soils.

(3) *Granite soils*, which, although they constitute only a small fraction of the fruit soils of the western Cape Province, are among the most valuable. Unfortunately, they occur mostly in areas climatically unsuited to fruit production and are usually planted to vines. They are generally deep and well drained with a tendency to cake when cultivated injudiciously. Plant food, apart from humus, is generally high, although phosphorus tends to be unavailable because of high acidity and iron content.

(4) *Alluvial soils*, which are among the most valuable in the western Cape Province, although they occur only in very limited zones. Their humus and plant food content is high, and, although for the most part deep, they are not entirely free from impenetrable layers in the sub-soil. They are low lying and, therefore, in places subject to water logging.

Soil Improvement.

From what has been said it will be obvious that few soils in the western Cape Province are really ideally suited to the cultivation of fruit, owing to sub-soil conditions and their low plant-food content. Delving and sub-soiling are, therefore, normal practices, which must be encouraged as long as the surface soil is not burried in the process.

Where the sub-soil is brought to the surface either by delving or levelling operations, a state of infertility is created which will take years to rectify.

In order to maintain the normal fertility of the soil it is essential that an annual fertilizer programme be followed which will replace the quantities of plant food removed by the crop. Before the war this amounted to 600 lb. superphosphate, 400 lb. ammonium sulphate and 200 lb. potassium sulphate per morgen. At present, however, these materials are quite unobtainable. Owing to the high

...r 1½ in
...eter. ...rtilization of the past it is not considered likely that ...chless... damage will result if superphosphate is excluded for a ...that ...so. The same cannot be said of potash and particularly ...action...gen, which will have to be augmented by the use of Karroo m...ure, stable manure, compost or green manure. The latter will b... described in another article of this series.

Three or four tons of Karroo manure per morgen can be recommended and can be supplemented by 800 lb. of *mixture II*, if available. The somewhat low nitrogen content of the fertilizer programme can be increased by green maturing with a leguminous crop.

Marginal soils must be avoided in any new plantings of orchards and vineyards as inherent soil fertility is a major factor in reducing production costs. Inherent weakness, such as inadequate soil depth and water holding capacity, cannot be rectified economically by any system of manuring.

Pruning and Thinning of Deciduous Fruit Trees:—

[*Continued form page 401.*

usually carry a somewhat heavier weight of fruit even though the average size of fruit is smaller.

If the size standards are set relatively low and the price of low grade fruit made sufficiently remunerative, the average farmer would probably not go to the expense of thinning his trees. However, any policy which aims at lowering recognized grade standards to an extent that would obviate thinning, would be detrimental to the interests of the industry—an industry which in the past has always prided itself on quality fruit.

Itinerary of East Coast Fever Commission.

The East Coast Fever Commission appointed by the Government and consisting of Mr. S. H. Elliott (Chairman), Senator P. J. Wessels, Mr. W. E. Stanford and Dr. P. J. du Toit, will visit the following centres to take evidence:—

Pietermaritzburg, 4 and 5 June 1943.
Vryheid, 7, 8 and 9 June 1943.
Dundee, 10 and 11 June 1943.
Durban, 12, 14 and 15 June 1943.
Empangeni, 16 June 1943.
East London, 26 June 1943.
Umtata, 28 June 1943.
Kingwilliamstown, 29 June 1943.

Any person who desires to give evidence before the Commission must submit to the Secretary, East Coast Fever Commission, P.O. Box 806, Pretoria, a short statement indicating the nature of the evidence which he proposes to give. This statement must reach the Secretary at the above address on or before 1 June 1943. After that date statements should be submitted to the Magistrate of the centre concerned.

Information regarding the place and time of the sessions can be obtained from the Magistrate at each centre.

J. COETSEE,
Secretary.

The Irrigation of Fruit Trees .. Vines.

P. E. le R. van Niekerk, Fruit Research Institute, Stellenbosc

THE production of high quality fruit and grapes depend primarily on climate, adequate moisture and a correctly balanced food supply. Although it would be unwise to underrate the importance of any one of these influences, there is a tendency, especially in the western Cape Province with its apparently high rainfall, to look to soil fertilization as the only means of rectifying growth abnormalities due to unsuitable climatic and moisture conditions.

In many parts of the western Cape Province the summer-rainfall has generally been assumed to be adequate for fruit and table-grape production, and moisture as a possible limiting factor has been largely ignored when new plantings were considered, frequently with serious results.

Only two types of soil moisture are of importance to the farmer as far as orchard or vinyard practice are concerned, namely (1) the amount of moisture the soil can retain under field conditions and, (2) that which penetrates soil layers beyond the reach of the roots and, consequently, becomes unavailable to the plant. The water retained by the soil can be divided into available and unavailable or dead water.

Capillary Movement of Moisture.

The maximum amount of water that a soil can hold is known as the field capacity. Plants grown on a soil moistened to field capacity will draw water until a point is reached at which the roots are unable to absorb any further quantities of water. The plant remains permanently wilted and the percentage of water left in the soil indicates the quantity of dead water or wilt point. All water above or beyond the wilt point is capable of capillary movement and is readily available.

Both the field capacity and the wilt point vary from soil to soil. So, for example, a clayey soil will hold more water than a sandy soil, i.e., it has a higher field capacity. On the other hand, because of the smallness of the capillaries in a clay soil, the water is retained by a much greater force than in the case of a sandy soil and, consequently, its wilt point is higher. It is not uncommon to find clay soils which in spite of their higher field capacity actually retain less available water than more sandy soils.

The soil zone in which most of the roots of a tree grow may be regarded as the reservoir, from which its food and water supply are obtained during the growing season. Water penetrating the soil, either in the form of rain or irrigation, will moisten a certain depth of soil only to its field capacity and no more. It has been found that the capillary movement of water from wet to dry soil is so slow that it cannot for practical purposes be depended upon for the distribution of moisture through the whole root zone. Water is absorbed much more rapidly from the soil by plant roots than it can be supplied by capillary movement.

The popular notions about light and heavy irrigations can, therefore, be very misleading. A light irrigation is one that wets a shallower depth of soil to its field capacity than a heavy irrigation, and certainly does not mean that it will moisten the whole root zone to a fraction of the field capacity. A definite amount of water is

x 1½ in.
...tween a certain depth of soil and any moisture entering the ...ess of this amount will be lost by drainage. The average ...the Western Province can therefore store only a small ...tion of the high annual winter rainfall.

Influence of Leaves.

During the whole of the growing season, i.e., while the plant has leaves, moisture is continually absorbed from the soil by roots and transpired through the leaves as vapour. This process, which is known as transpiration, is naturally affected by prevailing atmospheric conditions. The higher the temperature and the drier the air, the greater is the rate of transpiration. In this respect intense sunshine and dry winds are dominant factors in the Western Province from November to March. The amount of moisture transpired by a plant is largely determined by the total leaf surface, the size of the crop being of little account. The rate at which plants absorb moisture from the soil depends on the prevailing climatic conditions. As long as a supply of available water is present in the soil, trees will continue to function normally, As this supply is reduced a stage will be reached where the supply of available water becomes inadequate and wilting of the leaves results. When the wilt point is reached, however, the rate of transpiration is so greatly reduced that injury ensues. Growth is not affected by irrigation while the moisture content of the soil is still above the wilt point. The effect of such an irrigation is merely to increase the water supply.

Now that quality is demanded more and more by the consumer, greater attention is being given to the question of irrigation. This is particularly true of export grapes, where size, colour, palatability, flavour and storage quality are essential.

Moisture in the Surface Layer.

Over a considerable area of the Western Province where about 80 per cent. of the annual rainfall of 20-25 inches falls during the winter months from March to October, the depth of the majority of soils rarely exceeds three feet. It has been proved here and elsewhere that usually 60-80 per cent. of the roots are localized in the first three feet, whatever the depth of the soil may be. A tree will wilt when the moisture in this layer falls below wilt point, in spite of the fact that 20 per cent. of the roots are in deeper and moister layers.

Most soils in the Western Province can retain 4 to 8 morgen-inches of available water in the upper 3 feet. (A morgen-inch is a layer of water one inch deep extending over one morgen.) All winter rain in excess of this amount is unavailable to the plant as it is lost by evaporation and drainage. This means that only one-third to one-sixth of the rain falling between April and October will be available in spring. Those growers who cannot irrigate are therefore dependent on the effective rainfall between October and March, i.e., that part of the rainfall which becomes available for root absorption.

Various experiments in the most important fruit-growing areas have indicated the extent to which the summer rainfall is capable of keeping the orchard and vineyard soils above wilt point. It has been found that the rains in spring adequately replace the moisture lost through root absorption and soil surface evaporation, with the result that the soil still contains its field capacity towards the end of September. From the beginning of November onwards rain is not sufficient to prevent a gradual drop in soil moisture.

These experiments clearly showed that a rainfall of two or more inches in November would be sufficient to raise the soil moisture

content to field capacity. A rainfall of 0·5 inches or les. only two inches of soil; and as such rains are usually ... warm dry winds, the water evaporates so rapidly that lit... moisture is supplied to the trees and vines. Its only beneficia probably is the temporary reduction in the transpiration rate.

Factors limiting Moisture.

A study of the rainfall during the past 15 years has shown that normally the soils are moist to their field capacity until the end of September. On the other hand, a single fall of two inches of rain in November is unusual; in fact, it has occurred on only four occasions

Irrigating an orchard.
[*Photo: R. M. Nicholson.*

during the past 15 years. The normal precipitation varies from 0·2 to 0·6 inches per month during the period November to March.

The rate of loss of soil moisture at Stellenbosch during the growing season October 1934 to March 1935 was 0·14 inches per day. At this rate of moisture loss, most of the soils in the Western Province reach their wilt point by the first week in December, i.e., in years when rains not exceeding one inch fall in November. If no heavy rain falls in December a second irrigation is necessary during the first week of January. If, however, a heavy rain of ±2 inches falls in November, it is doubtful whether it will be necessary to irrigate before the end of December. Much will depend upon whether the rain falls at the beginning, in the middle or towards the end of November.

The above facts, naturally, do not hold for all sandy soils with excessive drainage, since they may require more water, nor for soils with a high water table which hardly need any irrigation.

Moisture is undoubtedly a limiting factor in the Western Province. For optinum growth a normal full-grown pear orchard

r 1½ in
...eter. ... morgen-inches of water during the growing season from
...chless. ... to May, for leaf transpiration and surface soil evaporation.

That ... the rainfall and the amount of available moisture that a soil ...ction ... ain is known, and the loss of moisture is 0·14 inches per day, ... amount of irrigation needed can readily be determined. For ...stance, if a soil can retain 7 inches of available water, and the rainfall between September and May is 13 inches, then the total amount of moisture available is 20 inches, so that 16 inches must, therefore, be given as irrigation water. It has been found that in normal years 4 irrigations of 4 inches each will be necessary at intervals of 28 days.

Effect of Droughts.

The question of how droughty conditions affect trees and vines naturally arises. Trunks and the terminal twigs of trees make most of their growth during the early part of the growing season (for plums it is more or less the middle of December.) During the period the fruit increases in size very slowly, but the moment terminal growth ceases a great increase in the rate of fruit expansion is noted. The dates for this occurrence in different fruits and vines vary with the earliness or lateness of the variety. If droughty conditions prevail while terminal growth is proceeding, the vegetable growth of the plant will be detrimentally affected. On the other hand, if the soil reaches wilt point after the period of maximum growth, but before the fruit has matured, both the size and quality of the crop will be seriously affected, although the growth may have been normal.

The soil moisture should, however, not be allowed to fall below the wilt point even after the crop has been picked. Trees and vines transpire, and therefore need water as long as they have leaves. Food reserves for use during the following season are formed after the crop is off; during this period the wood matures and fruit-bud differentiation takes place. If the leaves are allowed to wilt or to drop off prematurely, the wood can never ripen properly and, consequently, such wilting has a great effect on the life of the tree. This lack of interest in trees and vines after the crop has been picked, is one of the gravest errors in the Western Province, and is probably responsible for many of the physiological troubles militating against successful fruit and grape culture.

Root growth is also influenced by soil moisture. A shallow-rooted variety cannot be made to change its rooting habit to any great extent, because the roots of a tree cannot be forced down into the deeper soil layers by allowing the tree to suffer from lack of moisture. The roots of a deep-rooted variety can on the other hand be seriously limited by the presence of a high water table and by too many shallow irrigations.

Effective Drainage.

Many vineyards and orchards are in a water-logged condition in spring, when the new growth begins; this was particularly the case during the past two years with their exceptionally heavy winter rainfall. Although deciduous fruit trees and vines can safely stand a fair amount of submergence in winter when they are dormant, the same is not the case during any period of active growth.

Root growth begins long before the buds start active growth, and in water-logged soils the roots cannot develop in deeper levels and therefore tend to spread close to the surface only. When the

 [*Continued on page 438.*

Green Manuring of Vineyard Orchards.

P. E. Kriel, Fruit Research Institute, Stellenbosch.

GREEN manuring is the practice of ploughing in of green plants, sown either by nature or artificially. During war-time when fertilizers are very expensive, difficult to obtain and sometimes unprocurable, green manuring is particularly valuable.

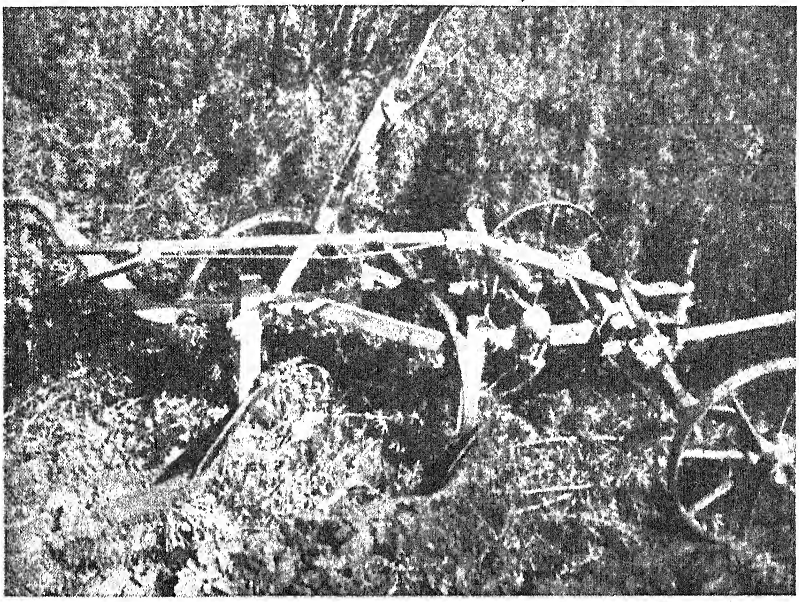


Fig. 1.—Ploughing under lupins with a double furrow plough.

The following are the main objects of green manuring:—

(1) Protection of the soil against erosion by means of cover crops.

(2) The absorption and storage of valuable plant foods (especially nitrates) which become available and are leached out of the bare soil while the trees and vines are dormant.

(3) The accumulation of organic material which is of such great importance for the structure of soils and the normal growth of plants.

(4) The application of nitrogen to poor soils by making use of legumes.

To ensure that wine and fruit farming should be financially successful, it is of the utmost importance to consider the acute shortage of organic material in our soils, and to improve the situation by all possible means. As a result of the replacement of animal power by machinery, farm manure, which was used with such great success in the past, is to-day practically unknown on most fruit and wine farms.

Although composting is practised on some farms, the production is usually limited by the amount of suitable organic material and the shortage of farm labour.

r 1½ in. ...manuring is the cheapest and most practical means of ...eter. ...the humus content of the soils of most farms.
...chless, ...

...visit to our fruit areas in July and August, just before the ...ards are ploughed, will reveal that most soils are bare and ...oded. On some soils grass and weeds start growing but, unfor-unately, these are often grazed too short soon after germination, ...ith the result that there is nothing left when the orchards are ...loughed. The soils which would profit the most by green manuring ...re usually bare. In some cases good crops of "gousblom" are

Fig. 2.—Cutting up lupins in a vineyard, planted 5 ft. by 5 ft.

found on rich alluvial soils. Unfortunately, it is only on a very small percentage of the total vineyard and orchard soils that any good cover crops are ploughed in.

Why the Lack of Cover Crops?

It is clear from the results of this investigation that the chief reasons for poor cover crops are the following:—

Climate.—During some years the winter-rains arrive too late for the cover crops to germinate in time to be ready for ploughing under at ploughing time.

Soils.—Most of the Western Province soils are poor and acid, with the result that cover crops are poor. Weeds like "gousblom" and "turknaels" are very sensitive to a nitrogen deficiency. Consequently it is a good practice to apply half of the annual fertilizer application in Autumn in order to encourage the growth of cover crops.

It is generally found that although irrigation is essential during the dry summer months, cover crops are poorer on all irrigated soils because the trees make better use of the soil reserves (especially nitrogen), with the result that the cover crop is starved.

In a cover-crop experiment at Paarl, the non-ir... produced 6·6 tons of dry material per morgen, while which were irrigated only once during the summer produc... 3·7 tons per morgen.

Grazing.—Early grazing just after germination is one of t... major reasons for poor cover crops.

Insects and fungus diseases.—Aphids, sand mites, caterpillars and the larvae of a small beetle sometimes damage gousblom and peas, while rust may be the cause of a total failure of the latter.

As most growers were dissatisfied with the results obtained with cover crops in the past, considerable attention was given to the subject, with special reference to the following:—

(*a*) The most suitable plants for cover crops in the winter-rainfall area, and the effects of green manuring on soil fertility.

The following table gives the results obtained with cover crops in different districts in 1938.

TABLE I.

Plant.	Height.	WEIGHT IN TONS PER MORGEN.				Ammonium Sulphate $[(NH_4)_2SO_4]$ per Morgen.
		Fresh.	Dry.	Cellulose.	Lignin.	lb.
Lupins	4′	41·1	6·7	2·1	·9	1,261
Lupins	3′ 2″	51·0	7·6	2·2	1·0	1,742
"Turknaels"	1′ 2″	72·2	5·1	1·1	·3	1,402*
"Gousblom"	1′ 2″	49·6	4·3	1·1	·4	630
Peas	2′	32·7	4·5	·9	·6	1,486
Rye	4′ 3″	23·9	4·1	1·6	·6	498

* The "turknaels" grew on an old manure heap site.

Experiments were also conducted on hilly Elgin gravel soils. The various crops were sown in strips under similar conditions.

TABLE II.

Old Peach Orchard.

Plant.	WEIGHT IN TONS PER MORGEN.			$(NH_4)_2SO_4$ in lb. per Morgen.
	Fresh.	Dry.	Lignin.	
Lupins	56·2	11·9	1·5	2,832
Tick beans	32·6	4·6	—	—
Peas	24·7	2·8	3	973
Clover (Med. Indica)	0	No harvest	0	0
Rye	17·5	4·5	6	580
Barley	11·8	3·7	—	—
Control (weeds)	0	No harvest	0	0

Table III.

Young Apple Orchard.

Plant.	Weight in Tons per Morgen.			$(NH_4)_2SO_4$ in lb. per Morgen.
	Fresh.	Dry.	Lignin.	
Lupins........................	78·0	16·5	2·1	3,927
"Gousblom"..................	53·5	5·1	0·5	794

Experiments were also conducted at Bien Donne (Groot Drakenstein) on two soil types. Twelve treatments replicated six times were tested on very poor sandy soil. The average results for each treatment *are given in Tables IV and V.*

Table IV.—*Sandy Soil.*

Plant.	Weight in Tons per Morgen.		$(NH_4)_2SO_4$ in lb. per Morgen.
	Fresh.	Dry.	
Lupins (January sown)......................	20·1	3·24	619·0
Lupins (April sown).........................	13·2	1·82	404·0
Peas (April sown)...........................	10·2	1·78	395·0
Med. Indica Clover (January sown)..........	0·2	0·04	11·6
Med. Indica Clover (April sown).............	2·6	0·44	127·0
King Island Clover (January sown)..........	0·2	0·05	10·0
King Island Clover (April sown).............	1·3	0·21	10·0
Tick Beans (April sown)....................	4·1	0·59	67·0
Rye (April sown)............................	5·2	1·12	118·0
Barley (April sown).........................	5·8	1·34	113·0
San Hennep..................................	0	0	0
Control (weeds).............................	0	0	0

It is clear from the results of Table IV that there was no cover crop on the control plots. Sunn-hemp, which gives such excellent results in the summer-rainfall area, was tested in this experiment as a winter crop, but it proved to be unsuitable.

The clovers gave very poor results although sown at different times and cultivated in different ways. Lupins sown in January gave the best results in all respects. Six treatments replicated four times were also tested on fertile alluvial loam soil.

Table V.—*Fertile Loam Soil.*

Plant.	Weight in Tons per Morgen.		$(NH_4)_2SO_4$ in lb. per Morgen.
	Fresh.	Dry.	
Lupins (January sown)......................	20·5	3·8	706
Rye (April sown)............................	19·4	4·7	592
Peas (April sown)...........................	4·8	0·7	190
Control (Gousblom)..........................	26·2	2·3	369
King Island Clover (January sown)..........	0	0	0
Med. Indica Clover (January sown)..........	0	0	0

Gousblom produces a heavy fresh weight crop and . weight crop on this soil. The production of January sown . almost the same as that of the same treatment on sandy soil.. production of nitrogen is again the highest in this treatment. In experiment rye produced the highest amount of dry material.

Soil samples were taken regularly every fortnight in order to determine the rate at which nitrification and the decomposition take place.

Fig. 3.—Cutting up lupins in a vineyard, planted 5 ft. by 5 ft.

From the results obtained in regard to the decomposition of organic material, it is clear that:—

1. Large quantities of cover crops must be ploughed in annually to give a definite increase in the amount of organic material per morgen.

2. "Gousblom" usually disappears within about a month after application, although large quantities were ploughed under. Consequently, this crop has a very small beneficial effect on soil structure.

3. A year after application lupin and rye cover crops still show a positive increase in the organic content of the soil.

From the results of nitrate determinations it is clear that:—

1. Nitrates are high, even in poor soils, after a good weight of leguminous cover crop material has been ploughed under.

2. In no case was a nitrogen starvation period determined in soils where legumes were ploughed under.

3. A good crop of leguminous green manure makes ample provision for the nitrogen requirements of fruit trees and vines.

Lupins prefer sand or sandy soils, but when once established generally give the best results on clay soils. On rich soils rye gives good results although it does not nitrify easily after being ploughed in.

Sowing and Ploughing in of Lupin Cover Crops.

Sowing.—Lupins were not very popular in the past as a green manuring crop, because the seeds do not germinate well. Experiments conducted prove that the seed will germinate better when sown in the summer.

	Sowing Time.	Percentage Germination.	Tons of Green Manure per Morgen.
Sandy soil	December	27	8·4
	January	14·5	8·1
	February	11·5	4·6
Clay soil	December	19	9·0
	January	32·5	5·9
	February	20·5	2·5

It is clear from the above that better germination, as well as higher weights of cover crop material are produced by early sowing.

Good results were obtained with lupins sown from the end of November to the end of February on non-irrigated soils. On soil irrigated irregularly it is advisable to sow at the end of February to prevent a percentage of the seed from germinating in summer. Lupin seeds which swell when put in water for a few hours could still be sown with success in March.

The weight of green manure produced depends on the density of the plants. Consequently, it is advisable to sow 200 lb. per morgen on all new soils.

Since all the seeds do not germinate during the first season, smaller quantities could be intersown later on. It is always advisable to inoculate seed when sown on soils for the first time. The seed is moistened with a solution of 1 lb. carpenter's glue in 4 gallons of water and then thoroughly mixed with soil on which lupins grow with success.

Ploughing under.—Lupins are easier to plough under than a good crop of peas or "gousblom". Disc ploughs and harrows give excellent results. Where the ordinary orchard or vineyard plough is used, it is advisable to make use of a heavy chain. An iron rod bent at right angles and attached to the beam of the plough, directly above the ploughshare, gives the best results. The horizontal part of the right angle should be slightly longer than the width of the plough furrow and four to six inches above the soil surface when the plough is in action.

Double-furrow ploughs give good results as the framework of the plough bends the plants forward before they are covered with soil.

Lupins four feet high in vineyards planted 4 feet by 4 feet were ploughed in with ease by making use of a special vineyard plough. ("Bankies" plough). Lupins could be cut up in vineyards, planted in narrow rows by making use of a roller fitted with blades.

Orchard Practice and Fruit Qua.

M. S. du Toit and J. Reyneke, Fruit Research Institute, Stellenbosch.

TO the grower, the middleman and the consumer, the outward appearance of fruit, and particularly size and colour, are the normal characteristics of its quality; they also accept in good faith that these characteristics serve as a reliable indication of the taste, aroma, juiciness and sugar: acid ratio which will develop at full ripeness.

The consumer furthermore demands fruit that will ripen normally, and as he usually resides at a considerable distance from the centres of production, this means that the fruit should be capable of withstanding the rigours of modern marketing, handling, storage and transport without breakdown.

A fruit remains a living entity for a considerable period after being picked from the tree; in other words, respiration and the resulting evolution of carbon dioxide continues. The greater the rate of respiration or breathing, the more rapidly will the reserve material within the fruit be used up, and the sooner will it become overripe and finally break down. The rate of respiration, that is the amount of carbon dioxide respired in a certain time, is therefore a means of gauging the keeping quality of fruit and particularly the influence of environmental factors on length of life.

The environment within which the fruit is placed, particularly temperature, profoundly influences the rate of respiration. In fact, the quantity of carbon dioxide given off is doubled for every 10° C. rise in temperature. A fruit kept at 30° C. lives twice as fast as one kept at 20° C., consequently, the temperature at which fruit is kept after being picked, greatly influences its subsequent history.

Although the scientific control of storage and transportation temperatures can do much to overcome weaknesses associated with the transport of perishable products over long distances, their successful application will depend on the inherent resistance of the tissues of the fruit to breakdown. Fruits of the same variety differ from farm to farm and area to area as regards inherent keeping quality, and therefore the rate at which the reserve material of the fruit is oxidized or used up during the process of respiration and ripening.

Whether the fruit will conform to the expectations of the consumer will therefore depend on (*a*) how and where it is grown, (*b*) the degree of maturity when picked and packed, (*c*) condition of handling, storage and transport.

In this article we will confine ourselves to (*a*), which is largely determined by cultural practice and orchard environment. If different fruits, or different varieties of the same fruit, be it apples, pears, peaches or plums, are compared as regards keeping quality, the striking fact emerges that fruit which have the longest maturing period and which, therefore, ripen later in the season, have the longest life after being picked. Apples can be stored for longer periods than pears, and pears than peaches, etc. Within the same kind of fruit, say apples, early maturing varieties which actually usually blossom later than later maturing varieties, and characterised therefore by a short maturing period, are more susceptible to storage abnormalities. The same applies to pears, the quicker maturing Bon Chretien having a far shorter storage life than later varieties.

The length of the period of development in the orchard greatly influences the length of life of the fruit. The saying " soon ripe,

Sowing

...en ", is therefore literally true in the case of the keeping of fruit. Quick development in the orchard invariably ...ts in fruit which oxidize their reserves at a high rate, and ...refore with a short storage life.

Because it usually pays to market fruit early in the season, there is a tendency among growers in early areas, not only to concentrate on early maturing varieties, but to attempt to shorten the period of development artificially. The storage life of such fruit is usually short and the quality inferior.

The period of development of the fruit and hence its inherent life, is influenced by a number of environmental and orchard factors.

Climate.

Although the climate of an area is the combination of a large number of factors, temperature, humidity and soil moisture are the three most important in so far as tree growth is concerned.

The rate at which the fruit swells out or enlarges, is at any particular temperature greatly influenced by atmospheric humidity. Plant food enters the fruit in aqueous solution, while the tree rids itself of excess moisture by means of transpiration through the leaves. Under conditions of high atmospheric humidity, transpiration is slow and the developing fruit tends to be large, soft and luscious. This type of fruit is very susceptible to temperature changes, sudden warm spells causing Kelsey spot in plums and bitterpit in apples, etc., in the orchard. They are in the same way, during storage, liable to low temperature injury resulting in abnormalities like internal browning and scald.

It is well known to most growers that fruits exposed to the sun on the outside of the tree are smaller, develop more slowly and are more resistant to injury than " inside " fruit. The climate of the western Cape Province is characterized by a humid spring and fruit developing period, followed by a dry, hot summer with low relative humidity. The longer the period of high humidity and the drier the succeeding summer, the poorer usually is the quality of the crop.

Much can be done by adequate pruning and thinning methods to obtain a normal crop. With increasing knowledge of climatic effects, it ought not to be impossible to base the marketing procedure on the climatic history of the crop.

Delayed Foliation.

A now well-known climatic effect is that of delayed foliation, resulting from high winter temperatures, particularly in low-lying areas, giving rise to low nutritional reserves in the tree and consequent uneven blossoming.

In years of delayed foliation the same variety at Groot Drakenstein will blossom nearly a month later than at Ceres, although the fruit will mature at about the same time. The period of development of the fruit is therefore shortened by about three weeks. Fruit of this kind usually has a short storage life and is very susceptible to cold storage injury.

Fruit varieties differ greatly regarding their susceptibility to delayed foliation and it is important to consider this factor in choosing varieties (see further article in this series).

The notion that the forces of nature are beyond control is not quite true in the case of fruit growing. Much can be achieved by the proper choice of varieties, by the application of correct methods of pruning and thinning and by adapting marketing and storage procedure to the nature of the development of the fruit.

Soil Fertility and Soil Moisture.

Nutritional, moisture and other deficiencies which have inhibiting effect on growth, accelerate the rate of development of th fruit. This explains why "golden berries" in the early Waltham Cross variety can be obtained only by inhibiting the growth of the vine. The practice does not, however, enhance the keeping quality of the fruit or the effective life of the tree or vine.

Soil moisture and available nitrogen are the two most important limiting factors in western Cape Province orchard soils, as 80 per cent. of the total rain falls in winter and early spring, with only a few inches during the hottest period between the middle of November and the end of March. This latter quantity is not sufficient for the moisture requirements of the plant during summer. As vineyard and orchard soils have an average effective depth of about 2½ feet, enough moisture cannot be stored in it during winter to safeguard the plant, especially late varieties, from moisture shortage during summer.

Soils are furthermore low in organic matter and nitrogen reserves, an inherent soil weakness aggravated by the methods of cultivation practised under our climatic conditions. Whereas in normal times this deficiency could be partially overcome by the use of nitrogen fertilizer, these are now unobtainable.

The use of organic manures has therefore become more essential than ever before. All efforts must be made to obtain farmyard manure, compost, etc., while legumes, such as lupins, must be used as green manures in orchards.

Size of the Crop.

One of the most important factors influencing the keeping quality of the fruit is the size of the crop. Trees with light crops usually bear large fruits which develop quickly and ripen early, with resulting poor keeping quality. In Australia it has become the practice to segregate light and heavy crops, and to market the former at once or to store it only for short periods.

Among the many reasons for irregular cropping, the following are probably the most important:—(1) neglecting pruning and thinning resulting in too heavy a crop in any one year; (2) poor fruit setting, resulting from nutritional deficiencies, particularly nitrogen, and a depletion of reserves in the tree; (3) climatic conditions.

The detrimental effects of irregular bearing on the tree itself, quality of the crop and marketing procedure, can be avoided only by sound orchard practice, and by regulating the size of the crop in relation to the croping power of the plant by means of adequate pruning and thinning.

SHORTAGE OF TETROL.

THE Director of Veterinary Services, Onderstepoort, announces that owing to the shortage of one of the ingredients of tetrol it is at present no longer possible to prepare supplies of this remedy. In view of the prevailing war conditions, it is extremely difficult to say when supplies will be available again, but as soon as this Institution is able to resume the preparation of tetrol, the necessary notification will be given in regard to the matter.

Farmers are therefore requested not to place any further orders since any money forwarded, must merely be refunded.

The Place of the Vine in Mixed Farming.

C. J. Theron, Head of the Department of Viticulture, Stellenbosch-Elsenburg College of Agriculture.

THE choice of this subject is not due to any slump in the wine industry. On the contrary, it is only the restriction imposed on planting which is preventing the increased cultivation of vines on a gigantic scale. The subject has been chosen because (i) in the long run, vines will benefit from a system of mixed farming; (ii) this is the time to make the best use of every inch of soil on the farm; (iii) it is too risky at present to concentrate exclusively on one branch of the industry.

On many farms, especially the smaller ones, it has become customary to cultivate vines only. Like so many other habits, this custom is born of a love of ease, and cannot be too strongly condemned since its consequences are: (i) all soil, whether suitable or not, is put under vines; (ii) exhausted vineyard soil is immediately used for replanting (and what chance has a young vine of ever proving a real asset to the industry in such exhausted soil?); (iii) very few animals are kept on such a farm, with the result that little or no manure or compost is made, even to-day when the shortage of supplies of fertilizer is so pronounced and our vines are in such dire need of manure.

Poor Vineyard Soil under Lucerne.

If the farmer removes his poorest vines from one or more morgen of vineyard soil and plants it to lucerne, which grows very well on such old vineyard soil, he will produce sufficient feed, in the form of green-feed and hay, to maintain a few cows which, with proper care, will yield a large quantity of manure per year. Keeping cows also creates an opportunity for converting into valuable fertilizer, either by dumping in the kraal or by making compost, all the dry leaves, grass, sweepings, vine shoots, undergrowth and weeds cut on the farm. After three or four years a different section of vineyard soil will have become unprofitable and may be used for the cultivation of lucerne. In the meantime the first patch of soil under lucerne will have been enriched by the organic material and nitrogen made available by the lucerne, and vine pests in the soil will have been eliminated through starvation. Consequently, this soil can again be put under vines, which will now have a much better chance of success. At the same time the farmer will have been better able to fertilize and cultivate the reduced vineyard acreage—and few viticulturists are to-day able to care for their vines as they should.

Make Better Use of Existing Vineyard Soils.

Even the existing vineyards may make a useful contribution to mixed farming, especially in the following respects:—

Winter grazing.—Grass grows moderately well in most vineyards during winter, but there are few on which the covering could not be considerably improved by sowing some grain crop in good time, like rye on poor sandy soil and barley or Sunrise-oats on loam soil. Many vineyards can be irrigated, and in any case, conditions in most of them are such that these cereals may be planted early enough to supply excellent grazing from June to the middle of August. For the next few weeks the crops are not grazed, and at the end of August or the beginning of September a good cover crop is ploughed

under. There is much to recommend the practice of allowin_ to graze in vineyards during winter. This is probably the ideal grazing for lambing ewes, especially with a view to the p. duction of fat-lambs. If the vines are not too young, even dair, cows, which are quiet grazers, may be allowed to graze in the vineyard provided the soil is not too moist. Horses and mules should be kept out, however.

Production of succulent feed.—This is practicable only where vines are fairly widely spaced, i.e., between rows 6 feet or more apart, and in young vineyards 1 or 2 years old. Such young vines are often overrun by watermelon or sweetpotato vines, and the harm done in this way is much greater than the small benefit derived from these crops. One row of kale and two rows of mangolds planted between every two rows of vines are much less detrimental to the vine and provide valuable feed for cows. In this way vineyard soil can provide feed throughout the year, and the farmer need buy only a limited extra quantity of concentrates to maintain high milk production.

Vegetable production.—Many farmers have shown that vineyard soil can be put to good use for the production of vegetables, for most of which there is at present an excellent market. The soil should be heavily manured and well cultivated, because both crops benefit thereby. On account of overshadowing in vineyards with full-grown vines, the choice of vegetables is confined to winter and early summer crops. In the case of young vines, vegetables may also be cultivated during summer, provided they are not planted too near the vines. On the whole, the following are preferable:—

(*a*) Crops which mature before September, e.g., potatoes and cabbage, so that the soil may still be thoroughly cultivated before it becomes too hard in summer; or those which are planted only after winter cultivation has been completed, e.g., beans.

(*b*) Crops which improve the soil, e.g., peas.

(*c*) Crops which do not overrun the vines, thus encouraging diseases like oidium.

(*d*) Crops which do not require too much water, especially while the grapes are ripening and during the harvesting period, since excessive water at this stage may be detrimental to both wine and table grapes.

Wider Spacing of Vines.

There are many ways, therefore, in which better use may be made of the soil in the vineyard. Occasionally the vines may suffer somewhat and cultivation may be hampered, but these are minor disadvantages and are more than compensated for by the double crop obtained. In any case, no permanent damage can be done to the vines. Bearing these factors in mind, farmers should even think of planting young vines wider apart in future since it is a recognised fact that in most cases vine-rows are still too closely spaced for all practical purposes. Vegetables will probably be most profitable to start with, but the system which offers the most permanent advantages is that in which vines and animals both play their part. Such a scheme will place the entire farming enterprise on a much sounder basis than would be the case in a one-sided system of viticulture, which usually leads to the gradual exhaustion of the soil and the increase of diseases and pests. Our ancestors possessed large herds of cattle and an abundance of kraal manure, and knew little of the pests and problems with which we have to cope to-day.

It is hardly necessary to point out that there is at present and at most other times as well, a good demand for milk, cheese, butter

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The Maintenance of Vineyards in Time of War.

C. J. Theron, Chief of the Department of Viticulture, Stellenbosch-Elsenburg College of Agriculture.

VITICULTURE, like all other agricultural enterprises, is at present experiencing a serious period of shortage in regard to such essential production requirements as labour, fertilizers, implements, sprays, etc. In these circumstances, the farmer is faced with one of two alternatives. He must either:

(*a*) maintain all his existing vines and cultivate and fertilize them less thoroughly; or

(*b*) maintain only as many vines as he can still tend effectively.

Of these two courses (*a*) is certainly a most short-sighted policy, since it will inevitably lead to the neglect of vines, overrunning of parts of vineyards by quick-grass and other weeds, an increase in pests and diseases, and, ultimately, the irreparable exhaustion of the vines.

Not only do all these factors result in a declining yield, which is usually accompanied by an increase in production costs, but also in a decline in the quality of viticultural products. Can South Africa afford this at the present time? As has lately been very clearly reflected in the difference between the prices realized for good and for poor wine, in the case of both table and distilling wines, we have at last, after years of struggling, begun to discriminate in favour of wines of better quality. This principle must not be abandoned again, but it can certainly not be carried into effect without ensuring that the necessary quality is maintained. Secondly, as a result of a combination of various circumstances, South African viticultural products are at present enjoying a better advertisement than ever before in their history, and the sacrifice of quality at this stage would prove fatal to the continued existence of our wine industry. If our products are to stand any chance of successful competition on the world markets after the war, quality will have to be the deciding factor, and that can certainly not be obtained with neglected vineyards.

Limit the Size of the Vineyard.

The second course, therefore, deserves greater attention, but this does not by any means imply that the farmer should destroy half or even a third of his vineyards. In every vineyard there are always one or more unproductive sections which are cultivated at a loss, or which yield wine of such poor quality that the price realized for the contents of the cellar as a whole is lowered. Now is the time to get rid of these vines. (The best way of utilizing cleared vineyards for other purposes is dealt with elsewhere in this issue.) In view of the present over-production of wine by at least 50 per cent. it does not seem at all unreasonable to advise farmers to convert their unremunerative vineyards into something more profitable. The adoption of this advice would certainly benefit the industry as a whole.

The Care of Vineyards.

After the elimination of unremunerative vines, attention can be paid to the care of the remaining portion of the vineyard, especially with a view to the following:—

Cultivation.—Vineyards demand a considerable amount of manual labour, especially where vines have been planted close

together, since cultivation round the stem of each vine can be effected only by hand. Even this can be reduced to a minimum, however, by removing alternate rows of vines in closely spaced vineyards which are still remunerative, by the correct use of the "bankies" plough, and by not creating conditions for unnecessary growth of summer grass round the stem by the vine. In addition, a considerable saving on cultivation can be effected to-day by making greater use in general of the plough and less use of the cultivator. Before the green crop becomes too dense to be handled in August-September, the rows between the vines are thoroughly loosened by ploughing away from the vines and the remaining strips dug with the spade. This should not be done when the soil is too wet or too hard, nor when there is any risk of the soil becoming compacted again as a result of rain immediately after being ploughed. Soil cultivated in this way does not readily become compacted, even if a second crop of grass should spring up. In addition, even if no rain has fallen in the meantime, it can easily be ploughed for a second time in October, not as deeply as before and towards the vine, without, however, unnecessarily covering the stem. The following are the advantages of this system: heavy green crops are effectively ploughed in; the vine gets a timely covering of loose soil over its most sensitive roots, i.e., those close to the stem; the structure of the soil remains so loose that summer cultivation can be dispensed with altogether or commenced only late in November; part of the summer grass crop is destroyed by the second ploughing; and grass which germinates at a later stage is easily eradicated in loose soil which has not yet been completely levelled.

On the other hand, in a vineyard which has been ploughed only once and levelled with a cultivator as early as September, this treatment must be repeated after every light shower of rain to control the growth of summer grass, with the result that the upper few inches of soil are pulverized by the numerous cultivator treatments while a hard pan is formed underneath and the stem of the vine is girdled with a dense growth of summer grass. The system of ploughing twice, as outlined above, can be strongly recommended under all circumstances, but at the present time it is of still greater importance in view of the shortage of labour. The farmer who cultivates his vineyard with a tractor and heavy disc harrow can carry out this operation with a minimum amount of labour and his soil will always have a thoroughly cultivated appearance, but even if the use of tractors should still be possibe for some considerable time to come, the frequent use of such expensive implements for the eradication of a small crop of summer grass remains a costly undertaking. The principal objection to the use of the disc harrow for summer cultivation, however, is that this implement not only pulverizes the soil and so destroys its desirable crumbly structure, but also encourages hardpan formation. Although the foregoing refers more particularly to vineyards which are not irrigated, the underlying principle of not cultivating soils too finely is also applicable to vineyards under irrigation.

Fertilizing.—This important question is a frequent topic of discussion at the present time, and every farmer should take full advantage of the hints given for the production and correct storage of as much farm manure and compost as possible, and for the best use of the available fertilizers. Farmers should not attach an exaggerated value to Karroo manure as some, unfortunately, have already discovered to their cost. Furthermore, it should be borne in mind that the nutritional requirements for the development of vine leaves, shoots and berry skins are far greater than for the production

The Maintenance of Vineyards in Time of War.

C. J. Theron, Chief of the Department of Viticulture, Stellenbosch-Elsenburg College of Agriculture.

VITICULTURE, like all other agricultural enterprises, is at present experiencing a serious period of shortage in regard to such essential production requirements as labour, fertilizers, implements, sprays, etc. In these circumstances, the farmer is faced with one of two alternatives. He must either:—

(a) maintain all his existing vines and cultivate and fertilize them less thoroughly; or

(b) maintain only as many vines as he can still tend effectively.

Of these two courses (a) is certainly a most short-sighted policy, since it will inevitably lead to the neglect of vines, overrunning of parts of vineyards by quick-grass and other weeds, an increase in pests and diseases, and, ultimately, the irreparable exhaustion of the vines.

Not only do all these factors result in a declining yield, which is usually accompanied by an increase in production costs, but also in a decline in the quality of viticultural products. Can South Africa afford this at the present time? As has lately been very clearly reflected in the difference between the prices realized for good and for poor wine, in the case of both table and distilling wines, we have at last, after years of struggling, begun to discriminate in favour of wines of better quality. This principle must not be abandoned again, but it can certainly not be carried into effect without ensuring that the necessary quality is maintained. Secondly, as a result of a combination of various circumstances, South African viticultural products are at present enjoying a better advertisement than ever before in their history, and the sacrifice of quality at this stage would prove fatal to the continued existence of our wine industry. If our products are to stand any chance of successful competition on the world markets after the war, quality will have to be the deciding factor, and that can certainly not be obtained with neglected vineyards.

Limit the Size of the Vineyard.

The second course, therefore, deserves greater attention, but this does not by any means imply that the farmer should destroy half or even a third of his vineyards. In every vineyard there are always one or more unproductive sections which are cultivated at a loss, or which yield wine of such poor quality that the price realized for the contents of the cellar as a whole is lowered. Now is the time to get rid of these vines. (The best way of utilizing cleared vineyards for other purposes is dealt with elsewhere in this issue.) In view of the present over-production of wine by at least 50 per cent. it does not seem at all unreasonable to advise farmers to convert their unremunerative vineyards into something more profitable. The adoption of this advice would certainly benefit the industry as a whole.

The Care of Vineyards.

~~After the~~ elimination of unremunerative vines, attention can be paid to the care of ~~the~~ remaining portion of the vineyard, especially with a view to the following:—

Cultivation.—Vineyards demand a considerable amount of manual labour, especially where vines have been planted close

together, since cultivation round the stem of each vine can be effected only by hand. Even this can be reduced to a minimum, however, by removing alternate rows of vines in closely spaced vineyards which are still remunerative, by the correct use of the "bankies" plough, and by not creating conditions for unnecessary growth of summer grass round the stem by the vine. In addition, a considerable saving on cultivation can be effected to-day by making greater use in general of the plough and less use of the cultivator. Before the green crop becomes too dense to be handled in August-September, the rows between the vines are thoroughly loosened by ploughing away from the vines and the remaining strips dug with the spade. This should not be done when the soil is too wet or too hard, nor when there is any risk of the soil becoming compacted again as a result of rain immediately after being ploughed. Soil cultivated in this way does not readily become compacted, even if a second crop of grass should spring up. In addition, even if no rain has fallen in the meantime, it can easily be ploughed for a second time in October, not as deeply as before and towards the vine, without, however, unnecessarily covering the stem. The following are the advantages of this system: heavy green crops are effectively ploughed in; the vine gets a timely covering of loose soil over its most sensitive roots, i.e., those close to the stem; the structure of the soil remains so loose that summer cultivation can be dispensed with altogether or commenced only late in November; part of the summer grass crop is destroyed by the second ploughing; and grass which germinates at a later stage is easily eradicated in loose soil which has not yet been completely levelled.

On the other hand, in a vineyard which has been ploughed only once and levelled with a cultivator as early as September, this treatment must be repeated after every light shower of rain to control the growth of summer grass, with the result that the upper few inches of soil are pulverized by the numerous cultivator treatments while a hard pan is formed underneath and the stem of the vine is girdled with a dense growth of summer grass. The system of ploughing twice, as outlined above, can be strongly recommended under all circumstances, but at the present time it is of still greater importance in view of the shortage of labour. The farmer who cultivates his vineyard with a tractor and heavy disc harrow can carry out this operation with a minimum amount of labour and his soil will always have a thoroughly cultivated appearance, but even if the use of tractors should still be possibe for some considerable time to come, the frequent use of such expensive implements for the eradication of a small crop of summer grass remains a costly undertaking. The principal objection to the use of the disc harrow for summer cultivation, however, is that this implement not only pulverizes the soil and so destroys its desirable crumbly structure, but also encourages hardpan formation. Although the foregoing refers more particularly to vineyards which are not irrigated, the underlying principle of not cultivating soils too finely is also applicable to vineyards under irrigation.

Fertilizing.—This important question is a frequent topic of discussion at the present time, and every farmer should take full advantage of the hints given for the production and correct storage of as much farm manure and compost as possible, and for the best use of the available fertilizers. Farmers should not attach an exaggerated value to Karroo manure as some, unfortunately, have already discovered to their cost. Furthermore, it should be borne in mind that the nutritional requirements for the development of vine leaves, shoots and berry skins are far greater than for the production

of wine and that the larger the quantity of such organic material returned to the soil, the greater will be the saving which can be effected on fertilizer. The cheapest method of fertilizing, however, is green-manuring. It is disquieting to see so many of our vineyard soils uncovered and exposed to erosion and leaching during winter. The best crop for green-manuring purposes is a legume like field peas or lupins, but in poorer soils where these crops do not thrive, a winter cereal can be substituted very successfully. In many vineyards no grass grows during winter merely because no seeds are present. If, however, all the weeds and grasses which are cleared from the farmyard and the sides of roads are collected and carted to such vineyards, this difficulty can be overcome very satisfactorily. On most farms far too much of this valuable material is still burned or altogether ignored.

If, in spite of all the measures advocated above, the wine-farmer still finds that his vines are not obtaining sufficient nourishment, he should prune them shorter than usual to enable them to bear a lighter crop, since under no circumstances must vines be allowed to become exhausted.

Control of Disease and Pests.—Not only are sprays and dusting materials very expensive, and in certain cases altogether unprocurable, but it is also very difficult to obtain the necessary spraying or dusting apparatus. When it is borne in mind to what extent these pests have increased and how many new ones have made their appearance, like bacterial blight, for example, we must confess that even in normal times the greatest difficulty was experienced in controlling them. If, therefore, they should now be allowed to remain unchecked for a few years, conditions in many vineyards will soon become uncontrollable. Most farmers already know from experience how part of a vineyard can become so severely infested with a pest like anthracnose, for example, that the only solution is to dig out the affected vines, and how one diseased patch can infect the entire vineyard year after year.

Consequently, it is now more important than ever to prevent a disease from getting out of control. To achieve this, it is necessary in the first instance, that the farmer should examine his vineyard thoroughly and frequently so as to discover the first signs of a disease. By the timely removal and burning of affected parts of plants as, for example, in the case of anthracnose, the disease may sometimes be checked without spraying. Often the most effective method of controlling insects is to collect them by hand, e.g., with a small bunch of dry leaves in the case of vine calandra. Furthermore, by applying these control measures only where they are absolutely essential, a tremendous saving can be effected. Many farmers, for example, simply smother their vineyard with sulphur, where there are actually only a few patches which are diseased. Such farmers take the easier course since it is much less trouble to waste sulphur than to keep a constant watch for the occurrence of diseases. Many of us have grown accustomed to farm according to a fixed recipe, the recipe very often being intended for an area totally different from the one in which we happen to be living. Now is the time to abandon such habits and to practise effective methods. Finally, always bear in mind that the success of the vineyard depends on the watchful eye of the farmer and the care with which he tends it.

Influence of Picking Time and Handling on Quality of Fruit.

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THE growing of fruit is becoming more and more a specialized business; competition is increasing and the public, as well as transport and marketing conditions, are demanding greater perfection and higher quality in the product. To satisfy this demand the grower is finding that he must familiarize himself with the fundamental factors that affect the condition of his product and adapt such knowledge to sound practice. Hundreds of tons of fruit are also undoubtedly lost every year in spite of great care exercised in cultivation, through picking fruit too green or too ripe, or because the methods used in cold storage and in transport are not totally suited to the requirements of the product. The subject of this article is, therefore, approached from a consideration of the cycle of changes through which the fruit passes during its development, and the outstanding chemical and physical changes which give the grower an indication of the right stage at which to pick the fruit. Unfortunately, practical methods for the quantitative estimation of these changes are not yet available.

Respiration Rate.

The rate of breathing or the intensity of respiration of a fruit, as measured by its evolution of carbon dioxide, provides a convenient guide in the laboratory to the physiological and chemical changes taking place in the fruit. This rate of breathing does not remain constant throughout the life of the fruit, but varies according to its stage of development; thus it is greatest at the beginning of the life of the fruit when the tiny cells composing its tissue are rapidly dividing; from then on during the development of the fruit in the orchard the rate falls, rapidly at first and then more gradually as the fruit nears maturity. At the onset of maturity, when colour changes and changes of texture take place, the rate of breathing shows a sudden and marked rise. This peak rate is usually referred to as the climacteric. During senescence the rate gradually falls away sometimes showing a rapid rise of short duration just before death. The determination of the respiration rate is then a useful tool for judging accurately the stage of development of the fruit, and enables the specialist to study precisely the effect of picking fruit of different stages of ripeness on their quality and storage life, and thereby to give the grower simple practical guidance for the best handling of his fruit. The portion of life cycle during which the fruit is usually picked, is a critical one because it may include not only the whole of the climacteric, but also part of the pre-climacteric and post-climacteric phases. In practice this is the period extending from the stage at which the fruit is almost fully developed but still hard and green to the stage where it is fully coloured and almost eating ripe.

Indications of Ripeness.

The relationship between these stages and the physical and chemical changes will be further considered in relation to the best time to pick the fruit.

Size.—By picking fruit too early the grower loses not only in size but also in weight and quality. When the fruit is graded it will be noticed that the biggest fruit consist mainly of the ripest, while the lower grades consist chiefly of the unripe fruit. With nearly all

varieties of fruit, fruit picked too early tends to wilt and shrivel in storage as the lenticels are not yet corked over, and the natural protective waxy bloom of the fruit is not yet developed. Consequently, it loses water more rapidly than if gathered in a more mature condition. Furthermore, such fruit never attains a good colour and flavour, and the grower may be losing as much as 10 per cent by weight of his crop. Size is undoubtedly a primary factor in determining demand and price, because of its association with composition and palatability.

Firmness.—From the stage at which the fruit begins to swell rapidly, its hardness decreases while its juiciness simultaneously increases. The cells rapidly enlarge, their walls become thinner, and the material which binds the cells together is gradually dissolved by enzymes. The riper the fruit, the greater the number of cells which will rupture under applied pressure or during mastication and, therefore, the more juicy the fruit.

The firmness of the fruit is measured by the well-known pressure tester; although not very accurate, it is nevertheless a good indication of the stage of ripeness of pears, peaches and plums, especially when colour changes are not very marked. For example, Bon Chretien pears should never be picked until they give a pressure test of about 22 lb., and peaches a pressure of under 20 lb., a fact which even to-day is often neglected.

Colour.—When the fruit is approaching full ripeness, its colour begins to develop, and it is important to remember that for the development of colour in most fruits light is necessary. The fruit must, therefore, be left as long as possible on the tree in order to develop its maximum colour, because only slight colour development takes place during storage. Fruit picked green always colours poorly, even the change from green to yellow is not normal and such fruit is pale yellow when ripe. Fruit from districts where development is slow and gradual and the developmental period is long, colours much better than fruit of the same variety where development is rapid.

In fixing the correct picking time, colour development is of great help. Peaches keep well and give good quality if they are picked when the green of the ground colour has changed to yellow, and if they give a pressure test of about 8 lb.; Santa Rosa plums if they are completely red coloured with a pressure test of about 15 lb.

Juice Content.—As mentioned above, the juiciness of a fruit depends on the number of cells which are ruptured when the fruit is subjected to pressure. In the case of apples and pears the juiciness increases to about 60 per cent. after which it gradually falls as the fruit ages. At the maximum point which coincides with the lowest point of the respiration curve just before the beginning of the climacteric rise, the fruit is apparently ready for picking. When the juice content has dropped to about 35 per cent. the fruit is liable to attack by fungal spores and when it has dropped to 20 per cent. it is no longer eatable and becomes mealy. The juiciness of the fruit varies inversely with its rate of respiration—the higher the respiration the lower the juice content. The juice content is therefore, a good test for keeping and eating quality.

In the case of peaches, the juice content also increases to a maximum as it approaches ripeness, but first drops and then increases again as it becomes eating ripe. Then just before final ripening, the fruit passes through a temporary stage of dryness. With the later varieties such as Peregrine the juice content drops as low as or lower than 10 per cent. at this stage, and it has been found

that if the fruit is placed in cold storage for more than three weeks at this stage it will emerge woolly. This is then clearly the cause of the well-known woolliness of peaches. Peaches which are to be placed in cold storage at 34° F. for more than 14 days must, therefore, be past this dry stage at the time of storage.

Sugar, Acid and Tannin.—As the fruit becomes riper, the sugar content of the juice increases, while the acid first increases and later decreases again, so that the sugar/acid ratio rises at the final stages of ripening. The tannin content and bitterness falls with ripening, so that when the fruit ripens on the tree it attains its best flavour and the high sugar/acid ratio coincides with no bitter taste. A

Fig. 1.—Plums must be picked with care.
[*Photo: R. M. Nicholson.*

fruit picked too green tastes watery, bitter and is flavourless; and even if it becomes well ripe after cold storage, it never develops the good flavour of a fruit picked at a riper stage. This is especially true of grapes, peaches and plums. In the case of starch-containing fruits, such as pears and apples, it is not so all important, presumably because of the large reserves of starch.

With grapes the sugar/acid ratio is a very useful and practical test for ripeness, apparently because they contain no reserve carbohydrates in the form of cane sugar and starch. Plums and peaches contain reserve cane sugar and, therefore, the sugar/acid ratio is not an infallible test, and the cane sugar content is very useful but not practical.

Apples contain starch as reserve, and use is made of this in order to test the stage of ripeness by dipping the cut surface of the fruit in a 1 per cent. iodine solution. The starch stains black, and as the fruit develops it begins to disappear from the core outwards. The quantity of starch which must have disappeared at the correct picking stage varies with different varieties. In the case of Ohenimuri and Cox Orange Pippin, for example, about two-thirds of the starch must be gone. In every case no starch must be present around the core area.

At the time of picking the season must be taken into account because, if it is an early year and if the fruit is inclined to ripen quickly, the inclination is to pick the fruit too ripe, while with slowly ripening fruit the tendency is to pick too green. In the former case the trees must be picked more often than in the latter.

By picking and storing fruit at the correct stage of ripeness many serious troubles like bladderiness of plums, woolliness of peaches, scalding of apples and pears, and bitterpit in apples can be controlled.

Shrivelling is a serious problem, and is caused by picking too green when the sugar content is too low to hold the water by osmotic pressure, and the waxy layer that retards water loss has not yet fully developed.

Tests for Ripeness.

The most useful tests with the different varieties of fruits are:

Grapes.—The sugar/acid ratio usually determined by the use of the refractometer.

Peaches.—The most desirable fruit is that which reaches the consumer in a sound condition and yet carries a good colour and is of good size. This objective is most likely to be obtained if the fruit is picked at the stage midway between the lowest point and the peak of the climacteric rise. In practice this stage is reached when the ground colour of the peach has just changed from green to greenish-yellow, and the green colour has almost completely disappeared from the flesh. This is also the best stage for picking for storage, and the pressure test is then just under 8 lb.

Plums (Santa Rosa).—Investigation has shown that plums should be picked just after the beginning of the climacteric rise in respiration rate. In practice this is the stage at which all the green ground colour has disappeared, the plum has a full red colour, but no trace of purple and is still quite hard. If this plum is picked earlier it does not ripen properly at ordinary temperatures, and although it ripens at lower temperatures, it does not attain its best flavour. Climate and soil conditions markedly affect the respiration rate and quickness of ripening of plums. The Kelsey behaves very similarly and should also be fairly well coloured at picking time.

Pears.—The pear should be picked just before the beginning of the climacteric rise. At this stage the pears are still green in colour, but with a decided tendency towards a lighter shade. If the fruit is to be marketed immediately, it can be allowed to remain longer on the tree than if it must be held in storage. The fruit increases considerably in size during the later stages of development and the sugar content rises. Pears picked too green lack flavour and tend to shrivel instead of ripening, lack sugar content and quality, and

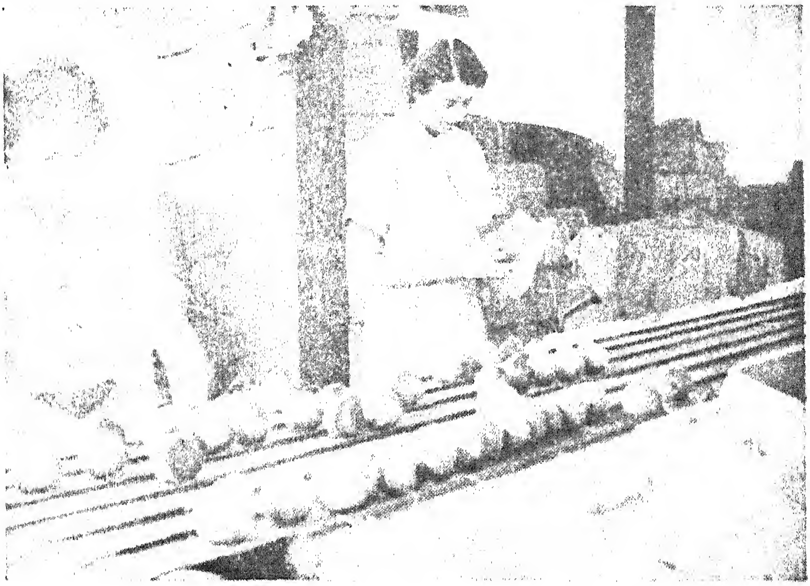

Fig. 2. Packing peaches.
[*Photo: R. M. Nicholson.*

break down and decay very quickly. The pressure tester and standard colour charts are the most useful aids to correct picking time.

Apples.—Fruit which is to be marketed immediately can be left on the tree until it is well coloured and almost eating ripe, as in this way the best flavour and colour is obtained. If the fruit is to be held in storage for an indefinite time after picking, however, the proper stage for harvesting becomes of very great importance. It must be remembered that the later the fruit is picked, the shorter its potential life and that storage methods only retard but do not stop the ripening process of the fruit. The more mature the fruit when placed in cold storage, the more rapidly fungal wastage and breakdown develop. On the other hand, apples picked too green, i.e., well within the pre-climateric stage are very liable to scald, or turn brown in storage. The least scalding occurs when the apples are placed in the store at the peak of the climateric. Scalding can, however, be almost completely eliminated by the use of an oil treatment. The most reliable guides to correct picking are the iodine test for starch, and the observation of colour change on the unblushed side of the fruit, the correct picking stage being when the ground colour takes on a decidedly lighter shade. Apples for cold storage should be placed in the store without delay, because

apples which are liable to bitterpit develop this trouble most severely at about 60° F., which is often approximately the air temperature at picking time.

Handling, Storage and Transport.

The handling, storage and transport of fruit is such an important part of the industry, and is so closely associated with maturity and quality that some of the most important points will now be briefly considered:—

Handling.—The keeping quality of fruit is determined by the rate at which it respires. This rate of breathing is partly controlled by the skin of the fruit and the waxy layer which forms on it. Consequently, if the waxy layer is damaged or removed, or if the surface of the fruit is punctured, the rate of breathing is increased and the life of the fruit shortened. Careless handling of fruit during picking or packing, or treatment with hydrochloric acid for too long a time and especially the use of wetting agents such as Areskap, have a very serious result. The development of "scald" in pears and apples is greatly increased by such treatment.

The higher the temperature at which the fruit is stored, the more seriously and the more rapid is the development of the damage. That is why under our climatic conditions the rough handling of fruit on the railways and on the local market can be so detrimental.

Storage and Transport of Fruit.—Although the importance of temperature control in connection with respiration has already been stressed, it cannot be too strongly emphasized under our extremely warm conditions during transport and on the local markets. Recent tests have already shown that with a slight measure of cooling to a temperature of only 60° F. a striking improvement in the life and quality of peaches and pears can be effected.

Pears, for example, which are very prone to blacken if they are stored slightly too long and then transported at a high temperature, are much less liable to the trouble if they are transported at 60° F. At this temperature the Bon Chretien develops its best flavour. At higher temperatures the fruit loses its characteristic flavour very quickly.

In connection with storage, the following few important points should be remembered.

1. The length of life of the fruit after it has been cold stored depends on the temperature and length of storage. For instance, Bon Chretien pears from low lying areas kept for more than three weeks at 34° F. blacken as soon as they are brought to a higher temperature.

2. Fruit that has reached the correct stage of ripeness must be placed in cold storage as soon as possible. Here the characteristics of ripening peaches can be recalled.

Use of Oil.

It has been found that scald and shrivelling which causes the greatest losses in Bon Chretien pears and apples which are cold stored for a long time at a low temperature can be very effectively controlled by dipping the fruit in a 5 per cent. Arachis (peanut oil) emulsion just before it is packed. The general keeping quality and appearance of the fruit is greatly improved. For apple varieties which are very liable to bitterpit in certain areas, e.g., Elgin, a lower concentration, say 2½ per cent. oil emulsion must be used;

higher concentrations accentuate bitterpit. Even peaches and plums stored at low temperatures are greatly improved by treatment with a $2\frac{1}{2}$ per cent. oil emulsion. If arachis oil is not available, standard summer oil emulsion such as that used for controlling codling moth will serve as a substitute. Oil cannot be used when the fruit is not cold stored. At high temperatues it has a detrimental effect on colour and flavour.

Ventilation.

The fruit gives off carbon dioxide in respiration and in closely packed stores the gas can collect to such an extent as to become poisonous to the fruit. The result is that unusual reactions take place and the fruit has a sharp alcoholic taste. Furthermore, the fruit also gives off other gases such as ethylene which hastens ripening, and also acetaldehyde and amyl esters of the fatty acids which can damage the skin and cause scalding. It is, therefore, essential that there is sufficient movement of the air in the store to prevent the gases concentrating and causing damage.

By improving methods of cultivation, manuring, irrigation and through picking fruit at the correct stage of ripeness, much can be done to improve the storage life and quality of our fruit, but to bring about an all round economic and permanent improvement, and to put the industry on a sound footing it is necessary:—

1. to make a careful selection of varieties in the planting of new orchards; and

2. to provide effective temperature control during transport, cold storage and marketing.

It ought to be our objective to plant varieties which have a short developmental period, namely, the early varieties such as the early apples, pears and Kelsey plums, i.e., all fruit which is very liable to physiological disorders, only in our best climatic areas as regards summer humidity and winter temperature. These varities should also be given the best soil in regard to fertility and water holding capacity.

The temperature to which fruit is subjected during transport and marketing is much too high and varies too much for the development of long keeping and good quality fruit. Fruit is often stored at 34° F. and then suddenly transported and marketed at a temperature of about 80° F. To overcome these huge variations in temperature, we must aim at a more medium temperature (60° F.) for both transport and marketing; the fruit will then ripen more normally and develop its optimum colour, taste and appearance.

It is essential that everyone concerned in the handling of fruit, the railway worker, the marketing agent, the middleman, as well as the consumer, should be educated concerning the correct handling of fruit. The consumer in particular should know that plums and pears, for instance, ripen much better and more quickly at 60° F. than at 75° F., which is the usual room temperature, and that the former temperature is in fact the best for ripening all fruit irrespective of its previous treatment; i.e., whether it has been cold stored or not.

List of Bulletins and Reprints.

Division of Chemical Services, Pretoria.

No.		Price.
*3	Notes on the chemical control of cattledipping tanks	—
*4	Composition of some indigenous grasses	—
*5	Investigation of different methods of testing Babcock milk bottles	—
*8	Comparative determinations of the lime requirements of soils by different methods	—
*10	Animal oils, fats and waxes	—
*14	Some analytical methods	—
*21	Quantitative determination of nitrates in soil	—
*22	White versus yellow maize as a pig and poultry food	—
*24	Nitrification in some South African Soils	—
*25	Revision of acid phosphates in acid soils	—
*26	Disaggregation of some rock and soil-forming minerals	—
*27	Twenty years of chemical progress in South Africa	—
*28	Representative Transvaal Soils: Springbok Flats Black Turf	—
*29	Representative Transvaal soils: Sandy soils and sandy loams on the older granite	—
*30	Preliminary chemical investigations of three South African plants	—
*31	Investigation into some physical and chemical changes occurring in grapes during ripening	3d.
*32	Legumes versus nitrate of lime as affecting the yield of barley ...	—
*33	Composition of ripe wine grapes	3d
*35	Representative Transvaal Soils: Highveld Black Turf	—
*36	Representative Transvaal Soils: Waterberg Sandy soil	—
*37	Toxicity of locusts poisoned with arsenical baits	—
*38	Influence of the admixture of different grades of limestone on the solubility of phosphoric oxide in superphosphate	—
*39	Preliminary note on the South African poison acocantherine	—
*40	Colouring matter in polysaccum crassipes D.C.	—

Obtainable from the Librarian, Division of Chemical Services, Private Bag, Pretoria.

* indicates that only English copies are available.

The Place of the Vine in Mixed Farming:—

[*Continued from page 427.*

and meat of good quality, whereas there is always a large surplus of wine.

Fowls and pigs may also be allowed in vineyards during the greater part of the year, and where vines have been trellised fairly high off the ground, these animals may remain there all the year round.

The Irrigation of Fruit Trees and Vines:—

[*Continued from page 416.*

soil dries out in summer, the plants have no drought resistance whatever. Where no irrigation is possible, such trees will be stunted and may even die.

High water tables in spring must be prevented by means of adequate drainage. A similar effect is produced by persistent shallow irrigation which allows the roots to die off in the deeper soil layers and produces a plant with a shallow root system. Irrigation should not be practised unless absolutely necessary; it should be carried out thoroughly or not at all.

Packing, Handling and Transport of Table Grapes.

S. J. du Plessis and J. Reyneke, Fruit Research Institute, Stellenbosch.

FROM time to time the attention of the table-grape grower has been drawn to various essential requirements for the production of table grapes. That table-grape growers in general responded very favourably to this advice is proved by the infinite care with which their grapes have been handled in the vineyards, in the packing shed and even up to the time of despatch. In spite of this meticulous care, however, apparently puzzling instances of failure have occurred

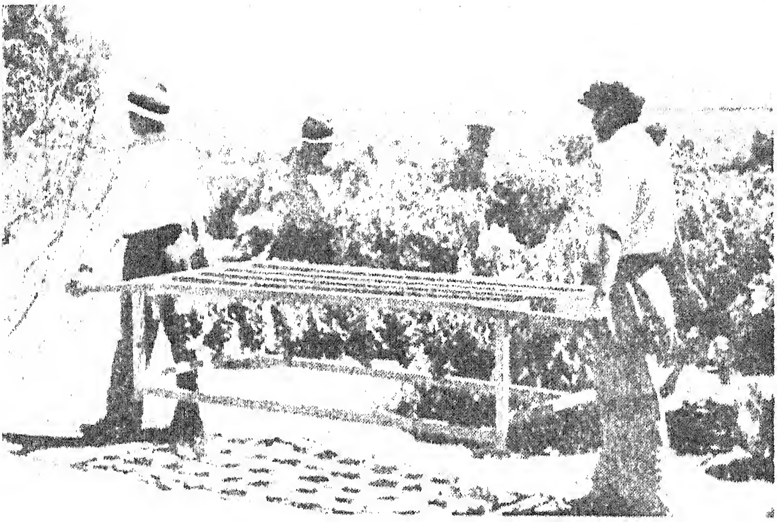

Fig. 1.—Choice grapes need careful handling.

which require solving. In several instances the occurrence of rain, excessive applications of nitrogenous fertilizers or severe thinning methods, etc., could not be blamed for the occurrence of wastage in the grapes. In order to gain some first-hand knowledge on the conditions of transport and handling to which grapes were subjected, a test trip with fruit was undertaken to Johannesburg and Pretoria during April 1942.

1. Ripeness at Time of Picking.

It is a well-known fact that grapes differ from plums, peaches or apples in that the former do not contain any easily accessible reserve carbohydrates, such as cane sugar or starch. Consequently, grapes cannot ripen when picked on the green side and reach the consumer in practically the same stage of ripeness as they were despatched by the producer. For this reason it is essential that grapes should be picked when they have reached the same stage of ripeness, which the grower would prefer for his own table.

Another important point to remember is that the colour of grapes shows no further development during transport and storage. It is known that the colour development of grapes is not equally optimal

in all the grape growing areas. It is in the interests of the grower, however, to allow for the maximal colour development before picking grapes. The so-called sugar: acid ratio test was introduced in order to judge the stage of ripeness correctly because colour development is so variable in different localities and on different soil types. Where doubt exists regarding the stage of ripeness, conclusions should be based on the results of sugar: acid determinations.

In this respect it is of importance to remember that the South African consumer definitely prefers well-coloured grapes with a high sugar content and, if possible, with an unusual flavour. For this reason the demand for well-coloured sweet Hanepoot grapes is practically unlimited on the South African markets.

2. Packing.

Some confusion regarding the packing methods to be adopted for South African requirements existed immediately after marketing overseas became impossible.

Various methods of packing were tested and inspected at different inland marketing centres. These tests showed that the optimal method of packing is that in which the grapes are packed, without wraping the bunches, in three-inch trays and in quantities of 10 to 12 lb. Paper linings for the boxes seem essential to prevent wilting of the berries. The insertion of even a thin padding of woodwool on the bottom of the box appears to be advisable to reduce flattening and cracking of the berries. The export pack type in which the bunches are wrapped and packed in 5½ inch trays, actually proved to be inferior to the above type.

Where unwrapped grapes were packed in large quantities, i.e., in bulk, in 5½ inch trays, apple boxes or in baskets, they landed practically without exception in a badly damaged state on the markets. The bottom layers especially very often had the appearance of a syrupy mass which attracted bees to market buildings.

In spite of this, however, it was surprising that many consumers on the different markets preferred grapes packed in baskets, especially Hanepoot. This preference is to some extent due to the relatively larger quantity of grapes which could be obtained for a certain price. Although this method of packing cannot be recommended for hygienic reasons, attention should be drawn to some faulty practices in its application. In the first instance, some farmers are apt to insert only a very thin paper lining prior to packing. Very often this lining has appeared to be totally inadequate to protect the grapes against damage. Furthermore, many growers are in the habit of carting the baskets to the vineyard, where they are immediately filled with hot grapes with hardly any preliminary trimming of the bunches. Some growers are also inclined to fill the baskets practically to overflowing, so much so that cases have occurred where fruiterers have to their own advantage increased twenty baskets to some twenty-five baskets of grapes. In an attempt to supply well-filled baskets, many growers fill them to above the level of the handles. This practice inevitably results in serious damage to the grapes during loading into the trucks. The truck-racks are so spaced that they will just allow a basket with handles to stand in an upright position. Any grapes bulging out about the handles are simply squashed by the rack above. In the interests of both grower and the consumer, growers are urgently requested not to exploit this preference of the consumer unnecessarily and to ensure that fruit packed in this container reaches the consumer in the best possible condition.

3. Transport.

In the case of fruit marketed overseas and especially in England, provision was made for a cold storage temperature of approximately 34° F., whereas the prevailing temperature at the time of marketing was generally 50° F. or below. The view that the temperature during the storage and transport of deciduous fruit is the most important factor determining the appearance, soundness and quality of fruit is well founded. This factor was therefore investigated more fully with particular reference to grapes.

Local investigation in cold storage chambers proved that the conditions of grapes improved with the lowering of temperature. At 86° F. grapes were apt to develop dry stalk to a serious extent, the berries showed a tendency to wilt, and were in many cases heavily infected with Rhizopus rot, which had a very deleterious effect on their appearance. Grapes stored at 60° F. were still in excellent condition, even after a fortnight; the stalks were still relatively green and the berries firm and attractive. Grapes kept at 45° F. and 34° F. were admittedly still very fresh when removed from cold storage, but almost invariably were inclined to become wet upon removal to ordinary room temperature. Fruit kept at these two lower temperatures were apt to rot sooner at room temperature (72° F.) than fruit kept at 60° F. All the data obtained pointed to the fact that the life of grapes removed from low to high temperatures is distinctly shorter than that of grapes removed from medium to high temperatures. It was repeatedly found that for the periods required for the inland distribution of grapes, 60° F. is the optimal transport temperature.

During the test trip to Johannesburg and Pretoria, temperature readings were taken of refrigerated and ordinary fruit-traffic trucks, and the condition of fruit from each of these was examined at regular intervals. At all places, except Beaufort West, it was found that moisture condensation occurred on grapes removed from the refrigerator truck (41° F.). The temperatures in the ordinary fruit trucks rose as high as to 96° F. From this it was apparent that neither the refrigerator truck nor the ordinary fruit truck provided the desired transport conditions for grapes. Earnest consideration of the problem of improving transport conditions in the case of grapes, therefore, appears to be very desirable. Apparently the aim should be to provide transport facilities which will allow of temperatures between 50° F. and 60° F. being maintained. These temperatures might possibly be obtained in trucks cooled by water evaporation as in coke coolers which are often erected by farmers for domestic use. Such cooling to the desired temperatures should be less expensive than the cooling of insluated trucks to 40° F. by means of ice.

4. Handling.

The care with which nearly all table-grape growers handle, inspect and pack their fruit, proves that the vulnerability of the grape is thoroughly realized. From the time that the grapes leave the consumer, however, they are repeatedly subjected to handling by groups of individuals who very often do not realize the extent of the damage which even one careless action may cause to the fruit.

The more responsible railway officials generally appear to be fully aware of the importance of careful handling. Owing to the heavy fruit traffic, however, personal supervision of all parties engaged in handling fruit is not always possible. Even farmers have

been found to be negligent in this respect. Cases have been observed where the employees of a farmer off-load a full load of fruit from the lorry in the most convenient way, i.e., by shooting the boxes from one man to the next as is done with bricks. As is to be expected, therefore, numerous cases of bad handling do occur on the railways. All these irregularities require careful consideration and call for correction. If consignments could be so arranged as to require a minimum of transhipment en route, this would in itself be a big improvement.

The authors are convinced that the careful application of the recommendations outlined above by all parties concerned would go far towards satisfying both the producer and consumer under existing South African marketing conditions. This in turn would undoubtedly increase the consumption of grapes.

Control of Pre-harvest Drop of Fruit.

H. L. Pearse, Fruit Research Institute, Stellenbosch.

THE fruit grower is often faced with such a spate of work during the picking season that with the available labour it is almost impossible for him to harvest the whole crop at the most suitable time, and any means of extending the picking season is, therefore, of great value to him. Increasing interest is, therefore, being shown in the use of growth-substance sprays which have proved effective in many instances, especially with apples and pears, in delaying and reducing the pre-harvest drop.

The substance most generally used is alpha-naphthalene acetic acid. The crystalline substance is dissolved in 95 per cent. alcohol (about one pint of alcohol is required for 100 gallons of spray) and the solution thus obtained is added to water in a spray tank to make a 0·001 per cent. solution. Approximately 4·5 gms. of the pure alpha-naphthalene acetic acid is required to make 100 gallons of spray. The solution is then sprayed on to the trees just as fruit-drop is commencing, an ordinary pressure sprayer being used. In some cases a spreader consisting of ¼ to ½ per cent. mineral oil has been added to the spray, but this does not greatly increase the effectiveness of the spray and can be omitted. The spray is best applied during periods of prevailing high temperatures, as the hormone then acts more quickly. The best time is, therefore, about midday in bright still weather. The hormone is not fully active until from 2 to 3 days after application and remains effective thereafter for a period of from 10 to 15 days, and if it is desired further to prolong the period before harvesting the fruit, a second spray could be given. A medium-sized apple tree requires from 10 to 15 gallons of spray.

The spray is not effective for preventing the drop, which sometimes occurs about a month after fruit set. Good results have been obtained with apples and pears, the pre-harvest drop in many cases being more than halved. There is as yet not sufficient evidence to hand as to their effectiveness with stone fruits.

The Treatment of Table Grapes for the Local Markets.

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IT has always been the practice of the table-grape grower to handle his product with reasonable care during storage and transportation in order to reduce wastage of his fruit to a minimum. In spite of this, however, many instances have come to light from time to time where severe wastage has occurred from causes over which the farmer could exercise little control. Now that grape farmers have to rely on the local markets for the disposal of their produce, many thought that wastage would be much less severe owing to the shorter distances over which the fruit must travel. During the past season, however, it has become abundantly clear that this is not the case.

Wastage of grapes is due mainly to two causes, namely:—

(a) *Dry stalk*, where the stalks dry out very rapidly, usually with the result that a high percentage of the berries fall from the bunch. This trouble is accentuated by dry, warm conditions in the vineyard and in the packing house just before and during picking and packing. The farmer obviously cannot exercise any control over these conditions, but this disorder to which Waltham Cross grapes are particularly prone is viewed by dealers at the various marketing centres in a very serious light. One of the first tests which they make on inspection is to give the bunch a jerk to see how many berries fall off, because they consider that each pound of berries which falls in this way is a pound's weight lost.

(b) *Rotting* is caused by a number of different organisms of which the most well-known is the so-called "grey rot" or Botrytis. Rotting of grapes is also influenced by the environmental conditions during picking and packing. The effect of rotting on the market value of the grapes is just as serious as that of dry stalks, and the tendency to rot is such an inherent characteristic of grapes from certain localities, that fruit dealers have learnt from experience to buy grapes from districts and farms which are known to deliver a high quality product.

If this question of wastage is to be solved, two virtually opposing sets of factors must be faced. An attempt was made to reduce dry stalks by spraying the boxes and packing materials with water, but this only served to encourage rotting. Other treatments, e.g., spraying the packing materials with a formalin solution, largely control rotting, but increase the amount of dry stalk.

Intensive investigation of this problem has been carried out during the past few years, first with grapes sent to London, i.e., under cold storage conditions, and subsequently with grapes marketed in South Africa. Numerous treatments have been tested but the great majority have failed to give the desired result.

Fumigation with Sulphur Dioxide.*

In the United States of America it has been the practice for some years to fumigate grapes for about 30 minutes with a 1 per cent. concentration by volume of sulphur dioxide gas, and very good results have been obtained. This gas, however, tends to discolour

* Full details of this work are contained in a scientific bulletin which has been submitted for publication.

the grapes, a danger which is also recognised in the United States. For this reason there has been a tendency recently to fumigate repeatedly with weaker concentrations of gas. Sulphur dioxide treatment has the great advantage that, if the concentration is optimal it not only reduces rotting, but also preserves the stalks in a good, fresh condition, and so almost completely eliminates berry drop.

From 1933 onwards numerous tests were carried out, as the result of which the use of sulphur dioxide treatment could not be recommended for South African grapes. Even when they are fumigated with 1 per cent. gas, the grapes are badly discoloured, and the result is more serious damage than that due to dry stalk and rotting.

Recently, however, Donen published the results of his experiments in which he found that Waltham Cross, Barlinka, Emperor and Almeria grapes from the winter-rainfall area can apparently be successfully treated with a 2 per cent. concentration of sulphur dioxide for 20 minutes.

This seemingly conflicting result prompted the writers to re-investigate very carefully the possibility of using sulphur dioxide gas. The work was carried out with Waltham Cross grapes from Paarl, Hanepoot from Constantia, and Barlinka from Somerset West. In repeated tests it was proved beyond reasonable doubt that all these grapes are seriously damaged if they are treated with only 1 per cent. concentration of the gas for 20 minutes.

Many different concentrations were tried in order to ascertain the safety limits for the treatment of South African grapes. In every case the quantity of gas actually absorbed by the grapes was determined. It was found that the grapes can absorb about 20 p.p.m. of gas with reasonable safety, and furthermore that this quantity is actually absorbed by the fruit if they are fumigated with 0·5 per cent. or less of the gas. The results obtained previously were thus confirmed, namely, that South African grapes are exceptionally liable to damage from the gas. Grapes which were fumigated for 20 minutes with 0·25-0·3 per cent. of the gas were not damaged, and arrived in an exceptionally good condition at Pretoria where they were personally examined by the writers.

In an attempt to learn more about the causes of the damaging action of the gas under South African conditions, the temperature of the fumigation chamber was varied in some experiments, and the temperature of the grapes in others. From these experiments it was clearly shown that the damage caused by the gas is greatly accentuated by an increase in temperature of the chamber or of the grapes, due undoubtedly to the greater quantity of gas absorbed by the fruit at higher temperatures. This fact partly explains why grapes in America are successfully treated on such a large scale even with 1 per cent. of gas. In practice all fumigation in the United States is carried out after the grapes are packed in trucks at a temperature of 50° F. Under experimental conditions instances of fairly serious damage of Sultanina (Thompson Seedless) have been described in America with an absorption of only 10 p.p.m. of gas.

The conclusion reached after carefully weighing the practical possibilities of the use of the gas under South African conditions, is that it is too much to expect the ordinary farmer to carry out treatment of grapes with the gas himself. Careful and absolute control during treatment is essential for success, and very few grape farmers would be in a position or find it possible to fulfil such conditions. Where farmers feel that they can undertake to carry out the

treatment, the grapes must be fumigated with a concentration of gas not stronger than 0·3 per cent. for 20 minutes.

South African methods of transport and handling of the fruit also make it very difficult at present for a scheme of central fumigation of grapes to be practicable.

Treatment of Grapes with Potassium Metabisulphite and Sodium Bisulphite.*

In an earlier article favourable results obtained by spraying a solution of potassium metabisulphite on the wood-wool packing of grape boxes just before the grapes are packed, have been described. In continuation of these findings, sample consignments of grapes so treated were sent overseas during the 1939-40 season, and the reports received were strongly in favour of the treatment. Not only was rotting greatly reduced, but the stalks were also preserved in a good fresh condition.

The beneficial action of meta is also due to the sulphur dioxide gas which the compound releases. Here, however, small quantities of gas are released continually for a long period, thereby exercising a long preserving influence on the fruit without causing discolouration.

Treatments with this compound were carried out in numerous tests during the 1941-42 season with the object of improving the condition of grapes for the local market. Some of the experimentally treated grapes were personally examined on arrival in Johannesburg, Pretoria and Durban. In each case the independent judgment of the inspectors of the Department of Agriculture and Forestry on the market was invited. Without exception the verdicts were always greatly in favour of treatment with potassium metabisulphite or sodium bisulphite. Grapes packed in treated boxes appeared fresh and attractive and their taste was in no way affected by the treatment. Not only was rotting of the fruit greatly reduced in comparison with untreated boxes, but in many instances dropping of the berries was also completely eliminated.

The treatment consists simply in spraying the packing material of the grape box uniformly with 20 c.c. of a solution containing 20 gm. of potassium or sodium bisulphite in 100 c.c. water. Given in more familiar terms, the solution consists of 4 ounces of either compound dissolved in 1 pint of water. Applied in quantities of 20 c.c. per 10 lb. box of grapes, 1 pint is sufficient for spraying 28 boxes, i.e., 1 tablespoonful per box.

Care in regard to the quantity of solution applied per box is very important, because excessive applications cause damage and discolouration of the grapes. In choosing an apparatus for applying the solution, this essential condition must be kept in mind. A serviceable spraying apparatus for applying solutions in such small quantities is not yet available. When the farmer is certain that he can measure the correct quantity for each box, an ordinary "flit" spray can be used. A very simple method of application is to use a small "Bakelite" or glass pepper pot into which a tablespoonful of the solution is placed and then sprinkled uniformly over the packing material in the box. (These compounds cause metals to rust.)

As wood-wool is very difficult to obtain at present, just a thin layer can be placed at the bottom of the box to absorb the solution and to ensure that damaging drops are not formed. The solution is then sprayed or sprinkled lightly on the wood-wool.

* These investigations are fully described in a scientific bulletin which has already been handed in for publication.

Codling-moth Control.

R. I. Nel and W. A. K. Stubbings, Fruit Research Institute, Stellenbosch.

THERE is every possibility that pear and apple growers will find the control of the codling moth an exceedingly difficult problem during the coming fruit season. Spray materials, such as summer-oil emulsion and fixed nicotine, will probably not be available in sufficient quantities for carrying out the customary spray programmes, and therefore, reliance will largely have to be placed on lead arsenate. Excessive arsenical residues, which have to a large extent been avoided by the use of fixed nicotine and summer-oil spray programmes during the past few years, will thus again become a bugbear for the majority of growers. Other factors likely to complicate the production of sound fruit will be the shortage of skilled farm labour, especially of sprayers, difficulty of obtaining spares for spray pumps, etc.

The enforced return to spray programmes of lead arsenate, in which ovicides do not figure to any extent, if at all, will undoubtedly result in very much less effective control of codling moth, especially in the hot inland areas, such as Ceres, Orchard and Groot-Drakenstein. Unless the incidence of attack is much below normal, it is doubtful whether the use of straight lead arsenate programmes in these areas will enable growers to keep the infestation below 40 per cent., in the case of Bon Chrétien and other early ripening varieties of pears and below 60 per cent. in many late ripening varieties. Apple growers who have been turning to fixed nicotine programmes to avoid leaf scorch will again be exposed to losses of this type and the risk of premature defoliation of the trees. Ways and means of meeting the situation are discussed below.

General Strategy of Control.

Whether the crop is to be disposed of as fresh fruit or is to be processed, it is of the utmost importance to control the first brood as thoroughly as possible (*a*) to avoid too heavy immediate reduction of the crop by early infestation which, in the case of unsprayed trees, can exceed 60 per cent., and (*b*) to prevent heavy moth increase and unmanageable incidence of attack by the summer broods.

It is essential that all sprays be applied thoroughly and at recommended strengths and time intervals. Attempts at economizing by cutting down the dosage per tree, the spray strength or number of applications against the first brood will be a penny wise pound foolish policy. Supplementary control measures should be practised as far as they may be practicable. Such measures include the scraping of trees to destroy overwintering larvae, the use of hessian or chemically treated bands to trap larvae, the picking out and thinning of fruit, etc.

Where it is not possible for growers to carry out a satisfactory first-brood spray programme on all their trees owing to shortages of spray materials, labour and equipment, *selective stripping* may be considered. To obtain thorough control, it is necessary to spray trees with poor crops as efficiently as heavy cropping trees. As the return from poor cropping trees will not justify the costs and labour of spraying, it will pay the grower to go through his orchards about the beginning of November and to strip all trees bearing uneconomic crops; such trees will not require further spray treatment. In orchards where crops are poor throughout, it will be practicable to

cease spraying after the first two sprays; these two sprays should be sufficient to prevent breeding of the codling moth in the young shoots and spurs of the trees. Stripping may be delayed until the beginning of November in order to utilize what fruit there is as a trap crop.

Growers should give serious consideration to the grafting over of undesirable varieties during the coming spring.

Spray Programmes for Pears.

1. *Hot inland areas such as Ceres, Groot Drakenstein, etc.*—Early blossoming varieties should receive their calyx spray when about half the petals have fallen, while varieties in full blossom around the middle of October should be sprayed before the petals commence to drop. Although the earliest blossoming varieties may receive their first spray in September, general spraying does not commence until October, when sprays should be applied at eight-day intervals. Three sprays will be required for all pear varieties during November at intervals of ten days, after which spraying may be suspended until the advent of second-brood eggs on the trees in December.

The first of these second-brood sprays should be given about 12th December, and should be followed by two further sprays at intervals of eight days. From this time onwards, spray should be given up to about the 20th of February at intervals of ten days.

2. *Coastal areas such as Elgin and parts of Stellenbosch district.*—Owing to the smaller codling-moth population and the lower incidence of third-brood attack, a lighter spray programme can be recommended for these areas.

The earliest blossoming varieties are in full bloom during September and should receive their calyx spray when half the petals have dropped. Varieties blossoming in October should receive their first spray before petal drop commences, and a second spray should be given eight days after the first. Subsequent sprays up to the middle of November should be given at intervals of ten days. A final spray against the first brood should be applied at the end of November, after which spraying may be discontinued until the second-brood eggs have been laid in December.

The first of the second-brood sprays should be applied around 18th December and followed by two further sprays at ten-day intervals. A fourth spray is required during the last week of January, and a fifth and final application around the middle of February for late-maturing varieties.

As it appears to be unlikely that either fixed nicotine or summer-oil emulsion will be available in adequate quantities for some time, the spray programmes given above are based on the use of lead arsenate throughout.* The spray mixture for all sprays recommended above will, therefore, be: 4 lb. lead arsenate and 4 oz. spreader per 100 gallons water.

Spray Programmes for Apples.

The spray programme recommended for apples in the main apple growing areas of Elgin, the Cold Bokkeveld of Ceres, the Koo and Langkloof is substantially the same as for pears in the coastal areas.

* Detailed spray programmes based on supplies of spray materials available, will again be sent to all pear and apple growers in the Cape Province in August or September. In the meanwhile growers are advised to conserve winter-oil emulsions for use in the codling moth spray programme.

Many apple growers have suffered severe indirect losses in past seasons from arsenical injury to their trees. Such injury can be materially decreased by the substitution of high grade slaked lime for spreader in the spray mixture. The spray formula recommended is as follows: 4 lb. of lead arsenate and 1½ lb. slaked lime per 100 gallons water.

It should be noted that the amount of lime recommended should be strictly adhered to. *A reduction may lead to heavy arsenical injury, while an increase will promote heavy run-off, which will seriously impair the effectiveness of the spray mixture against the codling moth.*

Spray Materials other than Lead Arsenate.

Two spray materials, viz. fixed nicotine and summer-oil emulsion, are likely to be held in small quantities by individual growers, and can be utilized in the spray programme as follows:—

(*a*) Summer-oil eumlsions should be incorporated in first-brood sprays only, and can generally be used to best advantage between the middle of October and the middle of November. The use of these materials after the beginning of December will complicate the removal of arsenical residues in spray programmes in which lead arsenate is mainly used.

(*b*) Where small quantities of fixed nicotine are available, the materials should be substituted for lead arsenate in the last one or two sprays at the rate of 8 lb. per 100 gallons.* By doing this, the removal of arsenical residues will be greatly facilitated.

Residue Removal.

(*a*) *Pears*.—With existing shortages of summer-oil emulsion and fixed nicotine, the very favourable position of fruit growers during the last few seasons in respect of arsenical residues on fresh and dried fruit no longer obtains. Washing the fruit in hydrochloric acid solution will again be necessary, and certain general precautions in the spraying and handling of fruit will have to be taken by growers. Important among such precautions are the following:—

1. Where more than two or three sprays of lead arsenate are used in the programme, summer-oils should not be applied later than the middle of November unless the crop is destined for canning or fruit for drying is to be completely peeled.

2. Spreader should be used in conjunction with lead arsenate to avoid a "blob" coverage, which is comparatively difficult to remove.

3. The fruit should be washed in hydrochloric acid as soon as possible after picking. If left overnight, waxing up will ensue, which will greatly complicate removal of arsenical residue.

Fresh and dried fruit conforming to the local tolerance of 0·02 grains arsenic per lb. can be produced with suitable washing treatment where spray programmes recommended for early maturing varieties in the inland and coastal area consisting of 10 or less sprays of lead arsenate and spreader are used. The arsenical load of dried pears produced from fruit receiving such spray programmes will, however, be very close to the limits allowed. It is, therefore, desirable in all

* Where the concentrated form of this material is used, only 3 lb. is required per 100 gallons water.

cases where pears are to be dried to substitute fixed nicotine for lead arsenate in the last two spray applications unless the fruit is to be peeled.

(*b*) *Apples*.—As all apples to be processed are mechanically peeled, the residue-removal problem in apples is limited to fresh fruit. In this connection immersion in 1 per cent. hydrochloric acid for 3 minutes should enable the fruit to meet the local tolerance for arsenic; this acid strength is obtained by adding one bottle of acid to 5 gallons of water. In cases where a high percentage of the apples have open calyx tubes (Winter Pearmain and others), the following special precautions should be taken to reduce acid injury and subsequent core rot:—

1. The dipping period should be accurately timed so as to be no longer than is absolutely necessary.

2. Shallow boxes should be used and the fruit only just submerged in the acid solution.

3. Slaked lime can be used in the subsequent water wash at the rate of 1 lb. to 50 gallons to neutralize any trace of acid left.

4. The final water rinse given should be liberal.

Oil Treatment of Fruit.

(*a*) *Pears*.—The keeping quality of the fruit is improved, the ill-effects of acid treatment neutralized and the evenness of ripening at air temperature improved by dipping the pears in dilute summer-oil emulsion just subsequent to washing for removing arsenical residue. A strength of 2½ per cent. should be used; this is obtained by adding 1 gallon of the oil emulsion to 39 gallons of water.

(*b*) *Apples*.—Pre-storage oil treatment is very beneficial to the keeping quality of the fruit. Immersion of the apples in dilute summer-oil emulsion at the strength of 2 per cent., obtained by adding 1 gallon of emulsion to 49 gallons of water, is recommended and should take place immediately after the fruit has been washed.

Although oil treatment is successful in masking arsenical residues from the untrained eye, the presence of arsenic in excess of tolerance will be revealed by the regular chemical analyses that will again be carried out during the coming season. Farmers are strongly warned against giving their fruit oil treatment only and omitting the necessary measures for first removing the arsenic.

Biological Control.

A considerable amount of attention is at present being given to the possibility of controlling the codling moth by utilizing its natural enemies. To this end two parasitic wasps attacking the larval stage of the pest were imported from Canada last year. These parasites are derived from the small stocks imported by the Canadian Government from France in 1939 to control the codling moth in Canada. Stocks of these parasites and of another species are being reared in the insectary for liberation and colonization in selected localities. Large quantities of living codling moth larvae or "worms" are required for this purpose and farmers with hessian bands round their trees for the trapping of larvae are urgently requested to get in touch with the Director of the Western Province Fruit Research Institute.

The Control of Fungus Diseases in the Orchard.

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THE fruit grower's policy, now more than ever, should be to learn to identify the diseases likely to occur in his orchards and to practice efficient and economical control measures. In order to do this, growers should not only familiarize themselves with the symptoms and spray schedules, but should also know something about the life-habits of the respective causal organisms, so as to be able to adopt the spray programme according to prevailing climatic and soil conditions and to practice subsidiary control measures apart from spraying, and thus economize in spray materials.

Apple Diseases.

The apple grower has to contend with two major diseases—apple scab (Fusicladium) and apple mildew.

(1) *Apple Scab.*—Owing to the fluctuation in *apple scab* severity from year to year, due to variations in climatic conditions, growers find it difficult to decide upon a policy regarding scab control. Some omit spraying entirely, and suffer heavy losses in years of scab prevalence. Others delay spraying until the first symptoms of scab are noticeable and then find that only part of the crop can be saved at almost prohibitive spraying costs.

The usual spraying programme giving satisfactory control under most conditions consists of five fungicidal applications timed according to the various stages of blossom-bud development, viz., " green tip ", " pinkbud ", " petal fall " and two post-blossom sprays, the strength of the spray mixture being decreased as bud and leaf development progresses. In addition, some growers apply a winter spray with lime-sulphur. Such a complete spray schedule, although effective, is costly. Furthermore, the fungicides employed are not always compatible with the spray-materials used in the codling moth control programme. Difficulty is also experienced in identifying the various stages of bud development in some localities and seasons due to " delayed foliation " effects. Fortunately, recent research showed that the above programme can be modified without reducing its effectiveness.

The highly concentrated, and therefore, most expensive winter spray with lime-sulphur, has no effect upon apple-scab control. Twig infections, the phase against which the winter spray is directed, apparently do not occur under western Cape Province conditions, the leaves which have lain on the ground throughout the winter constituting the only source of primary infections in spring. While only the new growth is susceptible to infection, all spray applications before the buds open, have no effect on the disease. Where scab is a factor to be reckoned with, however, it is of the utmost importance that all susceptible portions should be thoroughly covered with the spray material from the time of opening of the first buds and throughout the pre-blossom period.

As has already been stated, the practice of regulating the pre-blossom sprayings in accordance with definite stages in blossom development, is not always feasible, since the pre-blossom period may, in some seasons, be considerably prolonged and more than two pre-blossom sprayings are then required for proper protection of the

foliage. A much safer practice is to spray at intervals of 10 to 14 days. In the post-blossom period the intervals between sprayings may be prolonged to three weeks because of the slower rate of leaf-development.

If pre-blossom spraying is properly carried out, the tree will be free from infections at the time of fruit setting and there will, therefore, be no secondary infection sources of infection which are usually responsible for the fruit infections. However, to protect the developing fruit against possible primary infections from overwintered leaves on the ground (which may continue to liberate the scab spores until the middle of November during periods of rain), at least one spraying after petal-fall is required.

A B C

FIG 1.—Diseases of Pome Fruits: A. Septoria Leafspot on a pear leaf. B. Apple twig infected with Powdery mildew. C. Apple infected with Fusicladium.

The principle involved in apple-scab control by means of spraying is thus to protect susceptible parts of the tree against infection. There is no advantage in using more concentrated spraying solutions in the pre-blossom stages. In recent spray trials under severe scab conditions, the same degree of control was obtained by four applications of one per cent. lime-sulphur solution as with four lime-sulphur applications of 1 in 40, 50, 75 and 100 by volume, respectively. The only value of stronger spray mixtures in scab control is to destroy existing infections, but this will not be necessary if protective spraying is properly done.

Other fungicidal materials which may be used with equal success as protectives against apple scab are wettable sulphurs, colloidal sulphurs and the various copper compounds like Bordeaux mixture and copper oxy-chloride. Sulphur compounds and basic materials like Bordeaux mixture, however, cannot be used where "fixed", nicotine oil sprays are employed for codling moth control, in which case the grower's only choice is to use neutral copper compounds like copper oxy-chloride.

Apart from spraying, orchard sanitary measures to reduce the disease should not be neglected, but vigorously practised, since once the disease has been reduced to a low level, control by means of

spraying is greatly simplified. Any conditions which help to retain moisture after rains, are favourable for scab infection. In poorly drained orchards which are sometimes submerged for long periods after rains, the atmosphere remains damp for a long time, with the result that heavy dews are experienced at night and the trees dry off very slowly in the morning. Such conditions are particularly favourable for the development of the disease.

Since the scab fungus overwinters in the dead fallen leaves, any means consistent with horticultural practice, whereby the dead leaves are destroyed or buried before opening of the buds on the trees in spring, is to be recommended. During the previous war, with copper materials unobtainable in Germany, this was largely practised in that country, the leaves sometimes being raked together in furrows and buried.

(2) *Apple mildew.*—Fortunately, only the Rome Beauty and Rokewood varieties are seriously attacked by this disease. On these varieties the disease is, however, more difficult and expensive to control than any other disease in the apple orchard.

The hot sultry weather conditions with saturated atmospheric humidity which usually prevail during summer, particularly on the Bokkeveld plateau of the Ceres district, are very favourable for the development of mildew. For this reason mildew makes its appearance rather late in the season compared with the early appearance of scab.

The causal organism overwinters on the year-old wood of the apple tree, especially in the buds, the new growth being already infected when the buds open. For the successful control of the disease in summer, a winter spray application of lime-sulphur (1 in 15 by volume of 39 per cent. polysulphide content) is absolutely essential. This should be followed by summer applications on the same lines as recommended for scab, but preferably with sulphur spray-materials, as copper compounds are less effective against the mildews. Conditions remain favourable for mildew development till late in the season, and spraying must, therefore, be continued until at least the middle of December.

Pear Diseases.

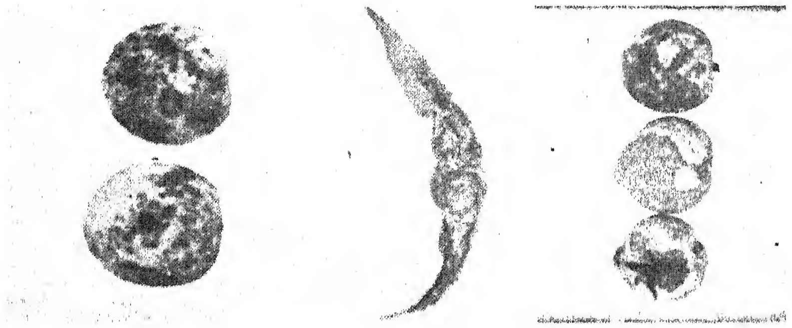
There are two pear diseases requiring control measures in the western Cape Province, namely, the Pear scab and the Septoria leafspot-disease.

(1) *Pear scab* is very similar to the scab-disease of apples and can be controlled on the same lines as outlined for apple scab. There is, however, one important difference. Pear twigs, especially of the Bon Chretien variety, are much more susceptible to infection than apple twigs, and these wood infections constitute another source of primary infections in the spring apart from the dead leaves on the ground. To eradicate these sources of infection on the wood, a spraying winter strength with lime-sulphur solution must be carried out at bud movement, but before any leaf surface is exposed to spray injury.

(2) *Leafspot.*—Compared with scab, the *Septoria leafspot* disease has a wider range of conditions favourable for its development, being very often found in orchards not subject to the scab disease. The disease occurs on practically all the varieties grown in the western Cape Province, but Beurre Bosc appears to be particularly susceptible, Doyenne du Comice being the only apparently immune variety.

Besides attacking the foliage, the disease also occurs on the fruit of Beurre Bosc, causing disfiguring spots similar to those on the leaves. The damage caused by this disease is, however, largely indirect. Diseased leaves are more seriously affected by the well-known lead arsenate leaf scorch than are trees on which the disease has been controlled. The ultimate effect is a reduction in the vitality of the tree as a result of the diminished functional leaf surface.

As in the case of apple scab, the first infections in spring are initiated by the dead infected leaves of the previous season lying



A B C

FIG. II.—Diseases of Stone-fruits: A. Apricots infected with the Gumspot disease. B. Peach leaf infected with the curly leaf disease. C. Peaches infected with the Powdry Mildew disease.

about in the orchard. Any control programme should, therefore, in the first place aim at the timely destruction or ploughing in of the overwintered leaves. Further safeguarding against infection can be procured by spraying the trees with a suitable fungicide at 10 to 14-day intervals, the first application being given as soon as the first leaves emerge from the buds. Where spraying for scab is regularly practised, no additional spraying will be required for leafspot. Besides the standard copper and sulphur containing fungicides, zinc compounds and summer-oil emulsions have also given satisfactory control of leafspot. Where the zinc sulphate-lime mixture is, therefore, to be sprayed to cure mottled leaf (zinc-deficiency), or where summer-oil emulsions are included in the codling moth-control programme no further measures need be taken against leafspot.

Diseases of Stone-fruits.

The grower of stone fruits has to cope with three serious diseases, viz., Curly leaf, Gumspot and Mildew, all three of which occur throughout the winter-rainfall area.

(1) *Curly leaf* attacks only the peach severely. It requires certain weather conditions which are not always present at the time when the tree is susceptible to infection. Thus, in some seasons, the disease appears in epidemic form, while in others it is almost entirely absent. Leaf curl develops most readily when the weather is wet and cold at the time that the leaves are unfolding from the buds. The peachgrower is, therefore, forced to spray for this disease every year, since he cannot know in advance what kind of weather will prevail.

Fortunately, leaf curl can be controlled very effectively by a single winter spray with either lime-sulphur (1 in 15 by volume) or copper sulphate (1 lb. in 20 gallons water). This application may be given at any time during the winter that fits in best with the control requirements of other diseases and pests or other horticultural practices, but must be applied before the first leaves emerge from the buds. If spraying is delayed until leaf portions are exposed, infection will already have occurred and spraying will be futile.

(2) *Gumspot diseases* attack peaches, apricots and almonds. Only the early peach and apricot varieties, like King Edward, Early Dawn and Alpha, suffer severely from this disease.

The causal organism overwinters on the tree, the twig infections of the previous season furnishing the inoculum responsible for infection of the young growth and fruit. The obvious control measure, therefore, is to kill out these wood infections by means of a strong curative spray while the tree is dormant. One winter application of lime-sulphur solution (1 in 15 by volume) or Bordeaux mixture (20 lb. in 100 gallons water), or copper oxide chloride (10 lb. in 100 gallons of water) is sufficient to control this disease. It is essential, however, that this spray should be applied before the advent of the winter rains. If spraying is delayed until after the first winter rains, the dormant buds become infected, where the fungus is then largely protected against the effects of spray materials.

(3) *Powdery mildew* must be regarded as the most serious disease of the peach. At present it occurs in the majority of peach orchards in Franschoek, Tulbagh and Ceres. Besides peach and nectarines, apricots are also attacked to a certain extent. Development of the disease is favoured by hot, sultry weather conditions.

Unfortunately, mildew is most difficult to control. Preliminary spray trials gave very unsatisfactory results and it would appear that more drastic measures will have to be included in future control experiments.

The causal organism probably overwinters on the year-old shoots and between the bud scabs, but apparently is so well-protected that the usual winter spraying cannot effectively destroy these seats of infection. Provisionally, growers are advised to prune out all infected wood during winter and to apply the usual winter spray with lime sulphur to which may be added with advantage ¼ lb. of a wetting agent per 100 gallons, followed by summer applications of wettable or colloidal sulphur sprays at intervals of 10 to 14 days. The summer spraying should begin as soon as the first symptoms of the disease are visible on the leaves and should be continued until about a month before picking time.

Nursery Quarantines.

The following nursery quarantines were in force on 1 May, 1943:—

(1) Page's Nurseries, Franschhoek, C.P., on citrus (all), for red scale.

(2) Beaulieu Nurseries, Forestdale Siding, P.B. Grahamstown, C.P., on citrus (all), for red scale.

(3) Municipal Nursery, Randfontein, on palms (all), for circular purple, Ross and Spanish red scales.

A Few Troublesome Orchard Pests in the Winter-rainfall Area.

R. I. Nel, Fruit Research Institute, Stellenbosch.

ALTHOUGH the codling moth is his most formidable enemy, the fruitgrower also has to contend with several other pests which may cause considerable damage if not kept in check. There is a real danger that some of these pests may get out of control with the curtailment or modification of customary spray programmes and

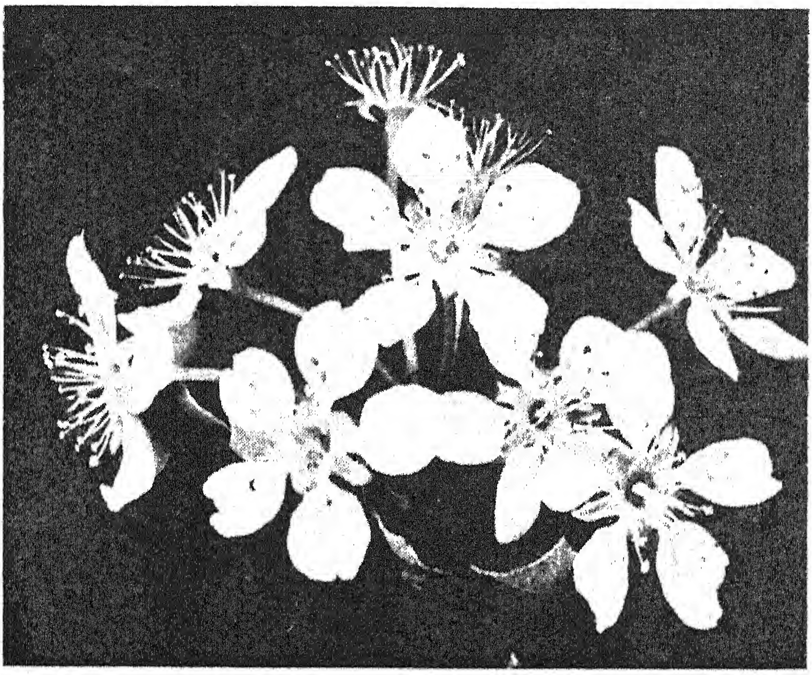


FIG. 1. Flower cluster from a healthy pear bud.

normal orchard practices that present conditions demand. Comparatively unknown pests may also make an appearance here and there, and although perhaps of a temporary nature, cause some damage and anxiety.

Two pests which are expected to appear on the scene in spring are black peach aphid and caterpillars; these pests are dealt with in separate contributions. A few others that will require special attention are discussed below.

Pear-bud Mite.

This pest may cause considerable crop reduction in pear varieties, such as Bon Chretien, Clapp's Favourite, Doyenne du Comice, Beurre Hardy and Louise Bonne by damaging the fruitbuds internally during

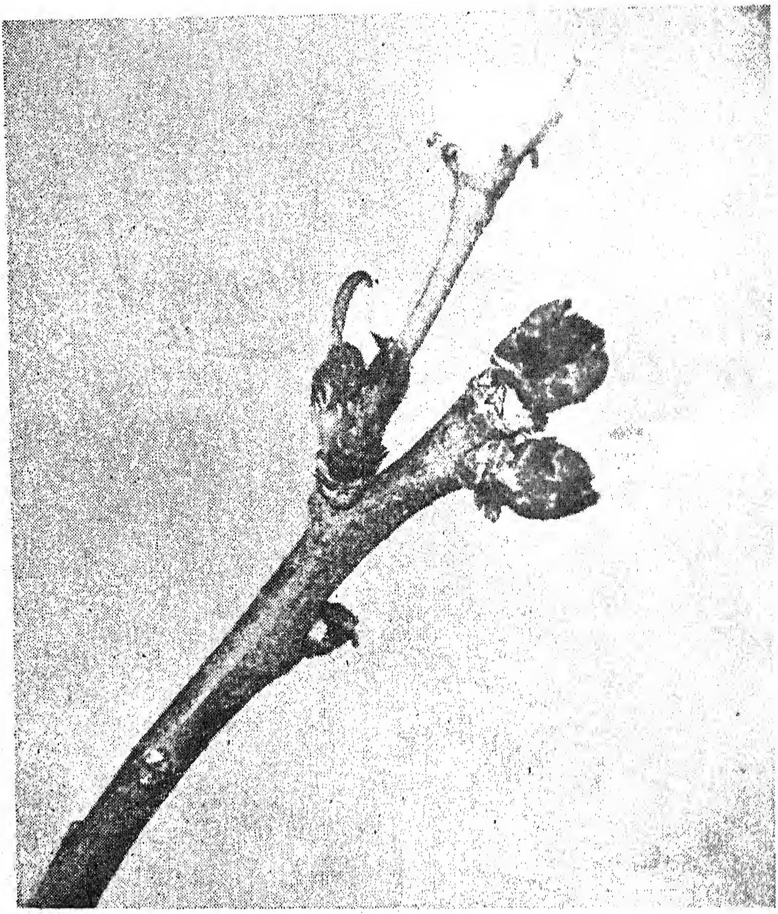


Fig. 2.—Fruit buds damaged by the Pear-bud Mite.

the winter months. As the mites are so small that they are almost invisible to the naked eye, the damage is often ascribed to other causes and no control measures are carried out. Under such circumstances the pest is inclined to become progressively more serious.

Where summer oil emulsion is added to at least three of the first four sprays against the codling moth as an ovicide, effective control of the bud mite may be depended upon without further treatment. With the present shortage of summer oils and their increasing elimination from the spray programme, the pest may be expected to increase considerably in most orchards.

There is, however, another very effective remedy which can be applied with advantage in present circumstances, namely, wettable sulphur. It is used in combination with lead arsenate in one or two of the sprays against the codling moth. Where the bud mite infestation is light, the wettable sulphur is applied with the first or second codling moth spray; and where it is severe, with the first and third codling moth sprays.

This spring treatment has no effect on the crop of the same season, but serves to protect the crop of the following season.

The combined spray-mixture is as follows:—

Lead arsenate	4 lb.
Spreader	4 oz.
Wettable sulphur	5 lb.
Water	100 gallons.

To prepare the above, the lead arsenate and spreader are mixed dry and then stirred into two gallons of water in a tin to form a thin paste. The wettable sulphur is then slowly added while the mixture is vigorously stirred. When a uniform paste, without lumps, is obtained, it is added to the water in the spray tank after setting the agitator in motion.

Mediterranean Fruit Fly.

This is the one pest which the consumer of fruit encounters with annoyance, as it is not a pleasant experience to cut open a well-coloured attractive peach and to find a mass of wriggling maggots in the decaying pulp around the stone! Such apparently healthy fruits are much too common in the fruit trade.

Although occurring chiefly in peaches, the fruit fly is also a nuisance in apricots, mulberries, late figs, late grapes, pears and apples. There is practically no common fruit that is not attacked and few wild fruits upon which it cannot subsist. The pest is particularly troublesome where there is a succession of fruits throughout the year in which it can breed.

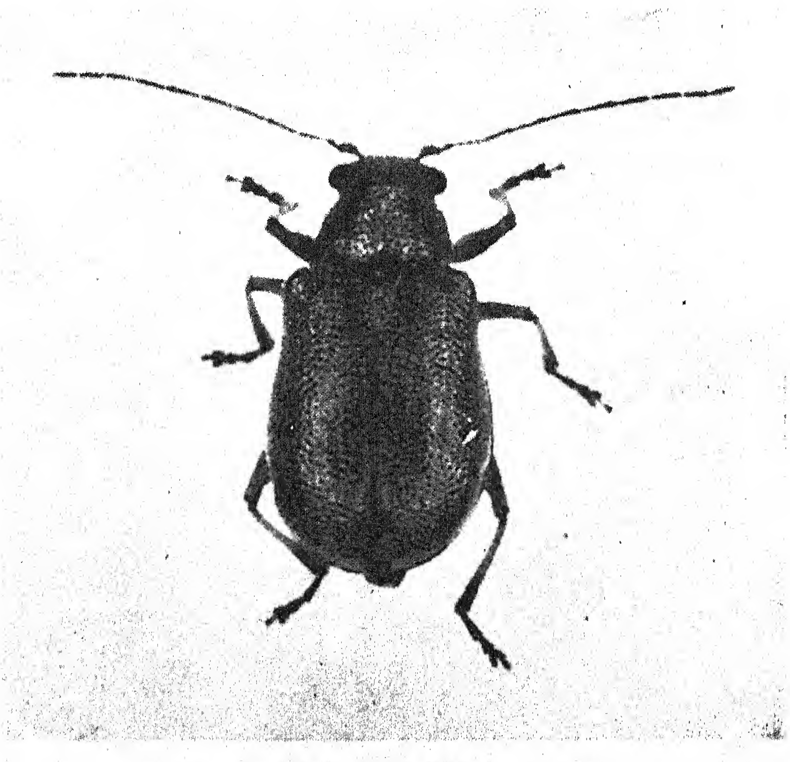


Fig. 3.—Adult Fruit Nibler (enlarged).

To control fruit fly successfully, the following points in regard to its life-cycle and habits must be kept in mind:—

1. When she emerges from the puparium the female fruit-fly is not sexually mature and can readily be poisoned with a sweetened poison bait before she commences to lay eggs about a week later.

2. Egg-laying occurs at intervals during the life of the female, which may last several months, poison-bait being readily imbibed, especially after a batch of eggs has been laid.

3. The pest is able to increase surprisingly rapidly, because several generations develop during the summer months and the females lay up to 600 and more eggs.

4. In the western Cape Province, the flies do not breed during the winter months and the pest is carried over from one fruit season to another apparently only by *overwintering adult flies*.

5. Only fruit which has attained a definite stage of maturity can be attacked with success.

Application of poison bait.—The following poison bait is recommended for use on deciduous and evergreen trees:—

Sodium fluosilicate	1 oz.
White sugar	2½ lb.
Water	4 gallons.

Provided that the bait is not intended for use on citrus trees, 1½ ounces of standard lead arsenate may be substituted for the sodium fluosilicate in the formula. The constituents must be well mixed and frequently stirred during use. White sugar is essential, since government sugar, brown sugar and treacle, which contain lime and other impurities, diminish the toxicity of the poison bait.

The bait is applied by spraying the mixture above the tree by means of an ordinary hand syringe, so that it falls on the leaves in the form of fine droplets. About half a pint of the mixture is sufficient for a fairly large peach tree.

Contrary to general opinion, the offensive against the pest must be launched, not during the summer, but during the previous winter. From May until September, all citrus, guava, loquat and evergreen hedges or ornamental shrubs in the vicinity of orchards and vineyards must be treated once a month with poison bait on a sunny day during dry weather in order to destroy as many as possible of the overwintering adults.

Towards the end of October, all stone fruits must receive an application of poison bait. From then onwards varietal treatment is practised, each variety receiving one bait-spray application per week during the four or five weeks preceding the date of picking. After rain the treatment must be repeated as soon as possible.

In vineyards the varieties susceptible to fruit-fly attack are first treated about six weeks before picking time, and once a week after that. Usually it is unnecessary to treat more than every third or fourth row.

Other measures against the pest include the destruction of infested fruit and limiting the chances for breeding and overwintering by removing citrus fruit, guavas and loquats from the vicinity of orchards and vineyards as far as possible.

Fruit Nibbler.

Lately this pest has been showing a tendency to spread. Whereas formerly it was troublesome only around Stellenbosch, Franschhoek, Paarl, Wellington and Tulbagh, it is now beginning to cause damage also in the Ceres and Villiersdorp areas. Fortunately, the damage is seldom widespread, being usually limited to certain orchards or parts of orchards. Plum, apricot and peach trees are liable to be attacked.

FIG. 4. Plum shoot showing damage caused by fruit nibler.

The adult beetles appear towards the end of August and are particularly active in September when the blossoms, buds, young fruit and even young shoots are damaged (see illustration). From the middle of October the beetles rapidly decrease in numbers, very few being present by the end of November.

The pest can be controlled satisfactorily by dusting with certain commercial dusting materials, when the beetles become numerous. Host plants, such as taaibos, etc., which may harbour the pest in the vicinity of orchards, should be treated with lead arsenate as often as is necessary (4 lb. to 100 gallons water). The ordinary or acid lead arsenate is inclined to scorch stone fruits, and must be used on fruit trees only as a last resort; 4 lb. lead arsenate should be used per 100 gallons of water, with the addition of 1½ lb. of finely slaked lime. Basic lead arsenate (5 lb. to 100 gallons water) is usually considered safe, especially when slaked lime is added. If summer-oil emulsion is available, ½ gallon may be added per 100 gallons spray mixture to make it adhere better. Spraying is not very effective, however, if applied before the leaves are present. In many instances, hand-collection of the beetles in the early morning remains the most practical method of control.

Materials for Winter Spraying of Deciduous Fruit Trees.

W. A. K. Stubbings, Fruit Research Institute, Stellenbosch.

THE fixed nicotine and summer-oil spray programmes against codling moth that have been in general use for the past three seasons can no longer be carried out by farmers, owing to the acute shortage of these spray materials. These spray programmes provided for the control of pests, such as, *red scale, bryobia mite, pear mealy bugs* and the *Australian bug* on pome fruit trees. As farmers will be forced by circumstances to return to summer spray programmes of lead arsenate, the application of control measures against the above-mentioned pests during the winter months will have to be resumed.

Two spray materials that have given satisfactory results against these pests during winter are lime sulphur and oil emulsions, used alone or in combination. The programme to be used depends on the type of pest to be controlled, the degree of infestation and the susceptibility of the infested trees to injury from sprays. The oil sprays used by farmers are usually proprietary emulsions of lubricating oils of approved specification which are compatible with lime sulphur. As an acute shortage of this type of oil spray is anticipated, use can be made of seal oil, which is procurable from the Superintendent of the Guano Islands, Cape Town, and has to be emulsified on the farm. A very satisfactory emulsion, stable in hard water and compatible with lime sulphur can be made as follows:—

One pint of commercial ammonia (20 per cent.) is added to about 2 gallons of water. One lb. of casein is then slowly sifted into the diluted ammonia, while the latter is beaten vigorously. When the casein is dissolved, the seal oil is slowly poured in, while the forming emulsion is stirred rapidly. Four to five gallons of seal oil are used, depending on whether a 4 per cent. or 5 per cent. oil concentration is required for spraying purposes. After the emulsion has been diluted to a thin paste, it is poured into the spray tank which is then filled to the 100-gallon mark with water.

Seal-oil emulsion prepared in this manner has an insecticidal value comparable to that of the standard winter oil emulsion, and with the aid of lime sulphur, which is fortunately still available to farmers, should help to bridge any gap occurring through shortage of mineral oils.

Winter Spraying of Trees.

Peaches and European Plums.—These varieties, particularly peaches, are sensitive to oil sprays; such sprays should, therefore, not be used. To control *bryobia mite*, lime sulphur should be applied at the 1 in 15 strength, i.e., 1 gallon of lime sulphur to 14 gallons of water.* Four to six ounces of spreader should be added to each 100 gallons of spray material used. This spray treatment tends to check black peach aphis and will give satisfactory control of peach-leaf curl.

Japanese Plums.—These plum varieties are often infested with *bryobia mite*. To control this pest, lime sulphur may be used at the 1 in 15 strength, or in severe cases a combination spray of seal-oil emulsion and lime sulphur may be applied at the 3-3-94 strength, i.e.,

* Based on polysulphide content of 35 per cent. by volume. Where lime sulphur of lower grade is used the spray strength must be increased proportionately.

3 gallons of emulsified seal-oil, 3 gallons of lime sulphur and 94 gallons of water. The seal-oil is emulsified as described above, except that only 3 gallons are added to the casein—ammonia mixture instead of the 4 or 5 gallons stipulated above. A convenient method of making up the combination spray is described below.

Pear and Apple Trees.—Either an oil emulsion alone or a combination oil emulsion and lime-sulphur spray may be used for the spray treatment of pear and apple trees:—

1.—Where a light to moderately heavy infestation of bryobia mite and red scale is present, a 5 per cent. seal-oil emulsion is recommended.

2.—In the case of a light infestation of mealy bug, the 4-4-92 formula, i.e., 4 gallons of seal oil (emulsified) and 4 gallons of lime sulphur to 92 gallons of water should be adopted. This spray mixture will also control light to moderately heavy infestations of bryobia mite and red scale.

3.—If trees are severely infested with one or more of the above pests, a combination of the 5-5-90 formula, i.e., 5 gallons of seal-oil (emulsified) and 5 gallons of lime sulphur to 90 gallons of water should be used.

4.—Where Australian bug is present, the trees should be sprayed, shortly before the winter spray is applied, at high pressure with water in order to break up the ovisacs and expose the eggs to subsequent spray treatment.

Seal-oil may possibly become available shortly in the form of proprietary emulsions containing over 80 per cent. oil. Such materials can be used at the spray strengths recommended above; although the oil content of the diluted spray will be somewhat less when proprietary emulsions are used, this reduction is not sufficient to impair the effectiveness of the sprays to any serious extent.

Mixing and Applying the Spray Materials.

Mixing.—As lime sulphur is soluble in water, no special precautions need be taken in diluting this material to spray strength. Where spreader is used, this material should be stirred into a thin paste with a little water before it is added to the diluted lime sulphur. To facilitate mixing, oil emulsions should be stirred to a thin cream with an equal volume of water in a separate container before they are diluted to spray strength.

When lime sulphur and oil emulsion are to be combined, the following procedure should be adopted. For example, when 100 gallons of diluted spray mixture are required, the lime sulphur is added to about 80 gallons of water in the spray tank. The oil emulsion is stirred into a thin fluid cream with an equal volume of water in a separate container and is then added to the diluted lime sulphur. After the tank has been filled to the 100 gallon mark, spraying may be commenced.

Spraying.—The necessity for thorough and careful spraying cannot be emphasized too strongly. Since only those insects that are actually hit by the spray are killed, it is essential to wet all parts of the tree thoroughly during spraying.

Branches or twigs missed during spraying act as focal points for the reinfestation of the trees, and any such lapses should be avoided. Close supervision of the spraying is, therefore, essential

if good work is to be done. Although a saving of spray material will result if the trees are pruned before spraying, the aim of growers should be to provide liberal quantities of spray material and to insist that all trees be heavily sprayed. Surveys have shown a strong tendency for farmers to underspray, a practice that can only lead to unsatisfactory pest control. In this connection, it would be more advisable, if necessary, to reduce the concentration of the spray materials used than to cut down the quantity of spray mixture used per tree. The use of disc plates with small apertures is undesirable on large trees when a fairly coarse drenching spray should be applied at a pressure of not less than 250 lb. per square inch.

Time of Application.

Peach and Plum Trees.—Where lime sulphur is used against *bryobia mite,* the best results are obtained when the spray is applied as late in the season as possible. In the case of soft fruits, spraying should take place about the beginning of August. Sprays applied after the middle of this month or after the buds have burst, are liable to cause injury, particularly in the case of early blossoming varieties.

Pear and Apple Trees.—Although the blossoming time of pear and apple trees may vary as much as three weeks from season to season, it has been found that oil sprays applied from the middle of August to the end of the first week in September generally give good results against delayed foliation. Early blossoming varieties should be sprayed first (in August) where this schedule is followed, while late blossoming varieties, particularly apples, may be sprayed up to the end of the first week of September. It has been found that very early spraying with oil emulsions (in June or July) may actually aggravate delayed foliation, and this practice should, therefore, not be followed. On the other hand, very late spraying may retard bud movement and fail to achieve the advantages of the early even and vigorous blossoming and foliation that follow well-timed sprays. Practically all the important commercial varieties of pears and apples—the variety Keiffer is a notable exception—respond to a correctly timed oil spray. Lime sulphur in combination with oil emulsion has no detrimental effect on the ability of the oil to correct delayed foliation.

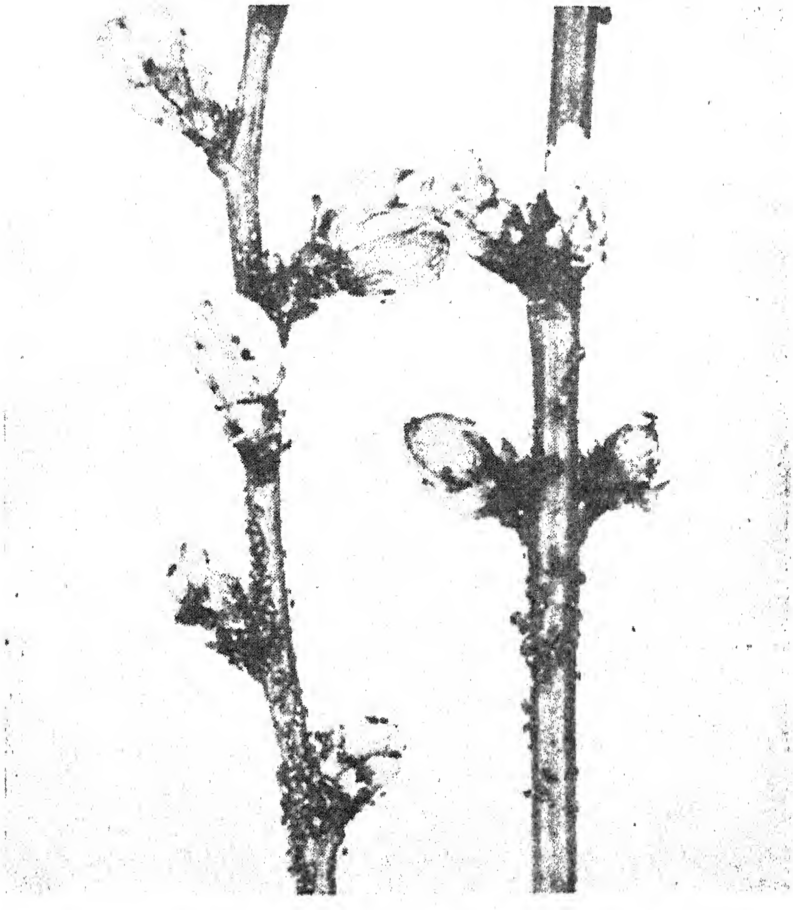
Spray Injury.—Spray injury to deciduous fruit trees in winter occasionally occurs, and results in dead or damaged buds or wood. Such damage may be due to excessively high concentration of spray materials, to application at the wrong time, or to injudicious spraying of varieties that are sensitive to a particular spray material.

Lime-sulphur injury occasionally occurs in peaches, particularly where the growth has been vigorous and the wood has failed to mature satisfactorily. The use of aged oil emulsions containing a high percentage of free oil and the combination of incompatible spray materials, such as miscible oils with lime sulphur, are known to cause severe injury. It must be stressed, however, that the types of spray injury described above do not commonly occur. Where spray materials are diluted and applied according to the above recommendations, spray injury is very unlikely to occur.

The Black Peach Aphid and Its Control.

W. A. K. Stubbings, Fruit Research Station, Stellenbosch.

APHIDES or plant lice are small inconspicuous insects which feed on many different types of plants, sucking the sap of tender shoots and buds. Over 70 species of these insects are found in the Union, several being of economic importance. One of these is the black peach aphid (*Anuraphis persicae-niger* Smith) which is not



Peach shoots and blossoms heavily infested with Black Peach Aphis.

only an important pest of the peach, but is sometimes present on plum and apricot trees. Both the winged and wingless forms of this insect are females which produce live young, the offspring becoming full-grown in about a week to ten days, when in their turn they can produce live young at the rate of 2 to 5 per day. Under favourable conditions, therefore, the rate of increase will be very rapid.

The black peach aphid usually overwinters on the roots of peach trees, although during mild winters small colonies may be found

clustering round dormant buds or feeding on sappy watershoots near the ground. The sexual male and female of the black peach aphid have not as yet been found in this country. As the buds commence to swell, the aphides move up the trunk and establish themselves on the most forward buds, generally near the distal extremities of the shoots where they commence to reproduce. Ants are generally in attendance in large numbers, being attracted by the sweet honey-dew excreted by the aphides. So rapid is the reproduction of the insect in early spring that around blossoming time the tree may be swarming with the shiny black aphides and serious economic injury may be caused through poor setting of flowers and dropping of sets, curling of the leaves and stunting of the young growth. When no control measures are applied, the aphides continue to increase in numbers until the weather becomes warmer. After a few hot days, however, the numbers of aphides are greatly reduced not only by the lethal effects of high temperatures on the insects, but by the attack of parasitic wasps, and predators, such as ladybird beetles, the lace-wing flies and the larvae of syrphid flies. By early summer aphid colonies are restricted to the shaded centres of the trees, where conditions still favour their survival. From this time onwards, adults are often noticed moving down the trunks towards the roots where overwintering takes place.

Control Measures.

Although the incidence of adverse weather conditions and natural enemies usually reduces the peach aphid infestation to negligible proportions by early summer, severe injury can be caused to the tree and its crop in early spring unless effective control measures are carried out. The most effective method of control is spraying the trees with nicotine sulphate 40 per cent., at a strength of 1 part in 400 parts of water to which 4 lb. of soap or ½ lb. of spreader per 100 gallons is added. The trees should be examined around the time the buds are swelling, and where aphids are present, a spray of the above formula should be applied without delay. A second spray application will usually be necessary about 14 days after the first, to control aphides and their progeny missed by the first spray and fresh infestation from the roots recurring after the first spray was applied. Under exceptionally wet conditions a third spray may be required; this is, however, very seldom necessary where the first two sprays have been thoroughly applied.

Making of Tobacco Extract.

Where scrap tobacco or waste is available on the farm, or is readily obtainable at a low price, a home-made extract can be made by soaking the finely ground tobacco leaves overnight in water, or by heating over a fire with the required amount of water and allowing to simmer (but not boil) for about 20 minutes. The proportions of waste tobacco required are as follows:—

Turkish tobacco, 4 lb. to 4 gallons water.*
Virginia tobacco, 4 lb. to 8 gallons water.
Nicotiana rustica, 4 lb. to 12 gallons water.

The extract should now be strained through cloth or finely woven hessian, as much moisture being squeezed from the leaves as possible. The latter are placed in a small quantity of water, this mixture being strained and used to bring the extract up to the required

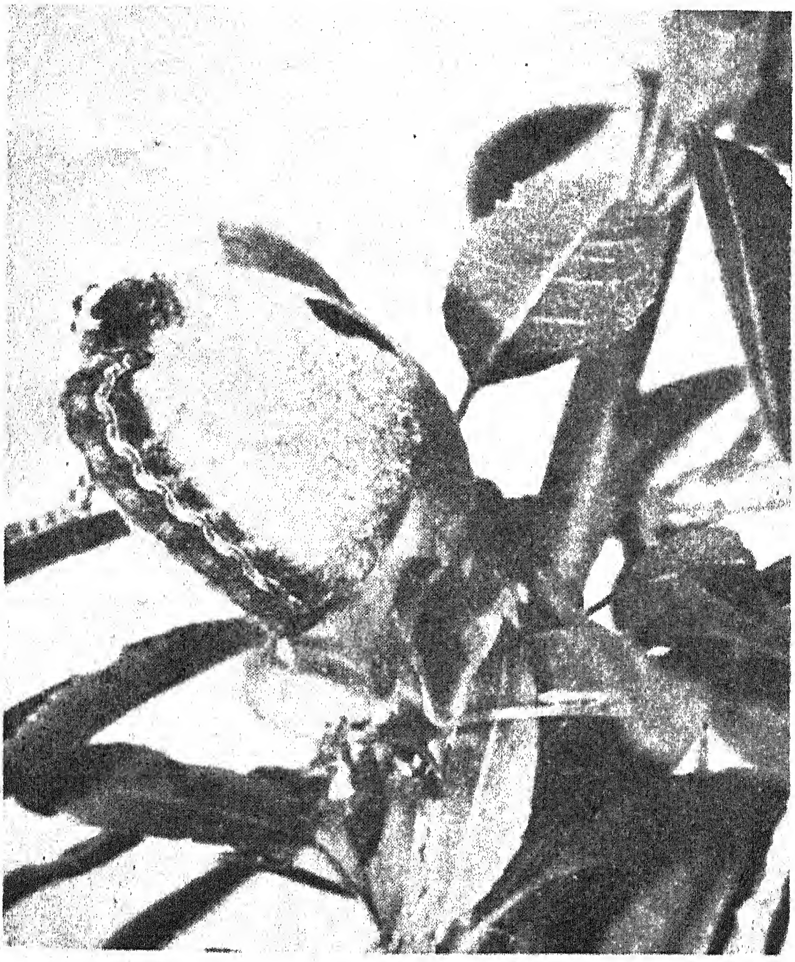
* Skibbe, A.M., Farming in South Africa, Vol. 1, No. 4, July, 1926

[Continued on page 480.

Caterpillars in Orchards and Vineyards.

W. A. K. Stubbings, Fruit Research Institute, Stellenbosch.

DURING certain seasons severe damage can be caused in orchards, vineyards and to a wide variety of annual crops by the larva of a moth, *Heliothis obsoleta* F., which is known amongst farmers by a variety of names, such as the cob- or earworm of maize, American boll-worm and the tomato worm.



Caterpillar feeding on a young peach. [Photo: R. I. Nel.

Although the pest is endemic at the Cape, the annual losses it causes are not very heavy, outbreaks being extremely localized and generally restricted to vines and vegetables. Usually the insect is kept under control by natural checks, but where climatic and biological conditions favour the multiplication of the insect, a general outbreak of caterpillars will result. Such conditions prevailed during the spring of the years 1925 and 1934 when severe damage was caused

to fruit trees and their crops throughout the western Cape Province, and it is not unlikely that caterpillars will be more numerous than usual next spring. The moth lays between 500 and 3,000 eggs, which, in the case of orchards, are laid mainly on the cover crops during September and October, gousblom being one of the plants greatly favoured by the moth. Even when present in large numbers, the larvae will remain feeding on the cover crop until this is ploughed in, when they migrate to the fruit trees in search of food. As the period of migration usually coincides with that of flowering and fruit-setting, much damage is done to flowers, fruit (see figure) and young growth. The swelling fruit buds of late-blossoming varieties of apples may also be attacked and severe damage will be caused when large numbers of caterpillars are present.

Outbreaks are of more frequent occurrence in vineyards than in orchards, particularly in areas where vegetables or tobacco are grown which can act as intermediate host plants for the insects. When they are present in large numbers, severe damage is caused by the larvae to the young shoots and foliage, and to the developing bunches.

A second generation of moths emerges during December and January. Although this brood is often heavy and widespread during epidemic years and lays many eggs, very little damage has hitherto resulted, as the natural enemies of the insect have become sufficiently numerous by this time to provide effective control.

Control Measures.

(1) *In orchards.*—As the eggs are laid on the cover crop during early spring and not on the trees, it is recommended that farmers delay cross-ploughing wherever practicable until the end of October during seasons when caterpillars are numerous. Oviposition of the moths and the feeding of the caterpillars will now be concentrated in the trap strips left along the rows of fruit trees. These trap strips should then be sprayed around the beginning of October with lead arsenate at the rate of 5 lb. per 100 gallons to control the caterpillars before they have disposed of the cover crops and migrated to the trees. Heavy dusting with a mixture of one part of lead arsenate by weight to three of slaked lime can be carried out instead of spraying. Where this precautionary operation has been carried out, further treatment against caterpillars will generally be unnecessary.

Where the above recommendation is impracticable, or has been imperfectly carried out, further control measures may be necessary. In the case of pear and apple trees, the lead arsenate sprays applied against the codling moth should be hurried on. Peaches, plums and other fruit trees should be sprayed with basic lead arsenate at the rate of 4 lb. per 100 gallons early in October. Acid lead arsenate causes severe burning to peach, plum and apricot trees, and its use should be avoided, although the addition of slaked lime to this material at the rate of 1½ lb. per 4 lb. of lead arsenate will greatly reduce the risk of injury.

A promising insecticide for use on stone fruits against caterpillars is fixed nicotine. This material has not been tested up to date and should be tried on a small scale first.

(2) *In vineyards.*—In the case of grape vines, hand-picking is recommended about the beginning of October where labour is plentiful and cheap. Where this is not the case, lead arsenate should be added to the sulphur dusts applied against *oidium* during October. At least two applications should be made with an interval of fourteen days, *one* part by weight of lead arsenate being added to each four parts of dusting sulphur used.

The Argentine Ant in Vineyards, Orchards, Packing Sheds and Houses.

C. C. Hattingh, Fruit Research Institute, Stellenbosch.

THE Argentine ant (*Iridomyrmex humilis* Mayr) was described for the first time from specimens collected in 1868 in Buenos Aires in the Argentine. Practically nothing further was heard of this insect until the beginning of the present century, when it appeared in many parts of the world as a serious pest.

As far as can be ascertained, it appears that this insect had been introduced into South Africa by 1901, when it was first noticed in parts of the Cape Peninsula. It is regarded to-day as a serious pest in all coastal areas of the Union and is also present in parts of Johannesburg and Pretoria.

One of the chief sources of food of the Argentine ant is the sweet sugary honeydew excreted by mealy bugs, aphides, etc. Wherever colonies of these insects are found they are almost inevitably visited by ants which engorge the sweet honeydew and carry it to their nests. The mealy bugs present in our vineyards and orchards have a number of natural enemies, such as several species of wasps and ladybird beetles; these natural enemies live on the mealy bugs and destroy them. The presence of ants in such colonies prevents these enemies from attacking the mealy bugs effectively, with the result that vineyards and orchards in which both ants and mealy bugs are present eventually become very heavily infested with the latter.

Control Measures.

Tests have already shown that the mealy-bug infestation in vineyards can be kept at a very low level by ant control alone. As far as present knowledge goes, the best method of eradicating ants is the use of a poisoned bait. The requirements of such a bait are as follows: First, it should be sweet and attractive to the ants and should not ferment readily when water is added to it. Secondly, the content of the toxic principle should be low; the reason for this is that were the first ants to feed die immediately after consumption of the poison, the other ants immediately stop feeding and very unsatisfactory results will be obtained. On the other hand, if the toxicity is low, the ants engorge the bait and carry it to the nest where it is fed to the young stages and queens, with the result that the nest is gradually weakened and eventually dies out.

The following bait is recommended:—

Syrup: 8 lb.
Sodium arsenite: 20 grams (4 level teaspoons).
Water: Approximately 5 pints.

First dissolve the arsenite in about 1 pint of hot water. Pour the solution into a tin, graduated in gallons, and add syrup. Wash syrup tins out with a little boiling water to prevent waste of syrup and add to bait in tin; add hot water to make total volume up to 1 gallon. Stir solution well until all syrup is in solution; the bait is then ready for use.

Where commercial syrup is difficult to obtain, a home-made syrup can be prepared as follows:—

Take 10 lb. of white sugar and add 2½ pints of water and 5 grams (1 level teaspoon) of tartaric acid. This mixture must then be

allowed to simmer for 45 minutes. A syrup of about the same consistency as commercial syrup or honey will be obtained, which can be kept in closed jars for any length of time.

To make up the poisoned bait, use 5 lb. of this syrup and add 2 pints of hot water in which 2½ level teaspoons of arsenite of soda have been dissolved. After the mixture has been well stirred, it is ready for use.

For further information, it may be mentioned that 10 lb. of white sugar will yield about 12 lb. of syrup, and that 1 lb. of syrup is used to prepare 1 pint of poisoned bait.

When preparing the syrup or bait, it is absolutely essential to use clean utensils. Special care should also be taken to avoid using tins or bottles tainted with oil or paraffin, as all petroleum compounds are extremely repellant to ants.

Application of Bait.

Vineyards.—Here the best method of applying the bait is to put it out in containers consisting of specially cut sections of Spanish reed ("Spaansriet"). Very satisfactory results are obtained with sections of reed about 8 in. long and with a diameter of at least ¾ in. The sections should be cut about 2 in. above a node and again about 4 in. below the same node, this time with a sloping cut of about 2 in. long (see Fig. A.). A small hole should be cut or bored through the reed about 1 in. above the node, so that the ants can gain access to the bait (see Fig. A.).

These reeds should be used wherever ants appear in vineyards. They are stuck into the ground alongside and in close contact with the vines or trellising poles; the more points of contact, the better the chances are ants reaching the bait. If a vineyard is heavily infested when baiting is commenced, experience has shown that the reeds should be placed alongside all stems, poles and anchor wires in the vineyard for the first two years of treatment. Subsequently one at each third or fourth vine will usually be sufficient.

After the reeds have been put out in the manner described above, they must be filled with bait. A very convenient and cheap method of doing this is as follows:—

A hole of approximately ²/₅th in. in diameter is bored longitudinally through an ordinary bottle cork. Where a cork borer is not available, a useful method is to burn the hole with a piece of red-hot wire. A length of sound reed about 6 in. long and with exastly the same diameter as the hole bored in the cork, is then cut, one end being sharpened by means of a sloping cut. A small piece of wood or cork is fitted into the other end of the section of reed, not entirely closing the opening but leaving a very small aperture (see Fig. B.).

The reed is then pushed through the hole bored in the cork so that the partially closed end of the reed projects for about 1½ in. from the bottom or smaller end of the cork. The cork with the reed is then fitted into the neck of an ordinary wine bottle half-filled with water (see Fig. C.).

If the bottle is inverted a small amount of water will run out through the reed, after which the flow will cease. The amount of water running out in this way depends on the size of the opening left at the blunt end of the reed. The size of this opening should be adjusted until a full teaspoonful of water runs out every time the bottle is inverted.

When the right-sized opening has been obtained, the bottle is filled with prepared bait to about the ¾ level, because difficulty will be experienced in getting the bait to run out when the bottle is too

An apparatus for applying the bait.

full. It will also be noticed that as the bottle gets empty slightly more liquid will run out at each inversion than when the bottle is nearly full. This difference in amount of liquid that runs out is so small that for all practical purposes the dosages obtained at each inversion of the bottle can be considered to be equal.*

All the reeds put out in the vineyard should now be visited and 1 teaspoonful of bait poured into each by means of the above-mentioned "automatic" bottle.

As soon as the reeds have been charged with bait, the upper opening must be plugged with woodwool or paper to prevent evaporation and to exclude rain and dust.

It is of the utmost importance that baiting should be started around the beginning of July, and if possible warm sunny days should be chosen for the purpose. The reeds should be recharged with bait every 14 days to three weeks until October. After this date the ants will not take the bait readily and operations can be suspended until the following July.

After the charged reeds have been in the vineyard for 14 days or three weeks they should be cleaned thoroughly before recharging. The best method of doing this is to leave them overnight in water and to scratch each one out individually with a piece of wire or wood the next day.

As the ants are hungry during the winter owing to the scarcity of their natural food, they take the bait very readily during this time. It is important, therefore, that the first few applications in particular should be made very thoroughly; in this way the ant population can be greatly reduced and very few ants will survive later in the season.

2. *Orchards and Ornamental Trees.*—Where fruit or ornamental trees, especially of the evergreen type, are infested with mealy bugs, Australian bugs, aphids, etc., such an abundant supply of honeydew is available to the ants that they do not readily take poisoned bait. In such cases it is best to prevent the ants from getting at this honeydew for a few days and then to put out the poisoned bait. To do this effectively, the trees should be banded as follows:—

Cut a piece of rubber band about 3 in. wide (old motor or bicycle tubes are very suitable) and a little shorter than the circumference of the trunk of the tree at about 2 feet from the ground. One end is then fastened to the tree trunk about 2 feet from the ground by means of two headless nails, one at each corner of the band. The band is then stretched lightly round the trunk and the other end secured by the projecting end of the same two nails. It is always advisable to place the band on that part of the tree trunk which is smooth and even so that no openings are left between the band and trunk. The whole exposed surface of the band is then covered with a tree tanglefoot, or any other suitable brand.

If this is properly done, the ants should not be able to cross the band and to reach the mealy bugs, scale insects, etc., on the tree. After three days poisoned bait may be placed next to the trunks of the trees. It is always advisable to put the band on at a time of the day when the ants are not active, because otherwise many ants will be trapped on the tree and not be able to reach the bait.

Care should also be taken to cut off or band all other parts of the tree that come into contact with the ground and by means of which ants can crawl up the tree.

* As this "automatic" bottle is a very cheap and effective apparatus for field work, it is suggested that it may also prove useful for the application of Derrisol, etc., against maize stalk borer, and other pests requiring similar treatment.

Most brands of tree tanglefoot do not last long during hot weather. It is, therefore, advisable to renew the tanglefoot bands before fresh bait is put out.

3. *Packing Sheds and Houses.*—Where ants are troublesome in dwelling houses and packing sheds, etc., putting out the bait in reeds is not very effective. There are various other ways of baiting which are much more useful.

The metal tops of beer or lemonade bottles may be filled with the bait and these placed in or next to the ant trails. The ants will take the bait readily for the first day or two, but after that the tops must be washed out and fresh bait put in before the ants will take the bait again.

The bait may also be put in small drops on floors or anywhere where the trails are noticed. If there is danger of spoiling the floors, pieces of paper with a few drops of bait on them may be used.

It is not necessary to leave the bait about in houses for longer than three days; it is better to remove the old bait at short intervals and to put out new bait about twice a week. Special care must be taken to prevent children and animals from having access to the bait, as it is extremely poisonous. As the bait is sweet, domestic animals are usually attracted to it and they must, therefore, be kept away. If by some accident a child should take ant poison, a dictor should be summoned immediately. In the meantime, the patient should be given one of the following emetics and such further steps taken as may be necessary to induce vomiting:—

1. one tablespoonful of mustard in half a pint of lukewarm water, or
2. two tablespoonsful of kitchen salt in half a pint of lukewarm water, or
3. two tablespoonsful of Ipecacuanha wine in half a pint of lukewarm water. .

After the stomach has been thoroughly emptied, keep the patient warm and in recumbent position until the doctor arrives.

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Sulphur for the Control of Vine Diseases.

S. J. du Plessis, Fruit Research Institute, Stellenbosch.

SULPHUR was the first dust used for the control of fungous diseases of crops. Sulphur is well known to vinegrowers, many of whom use only this fungicide for the control of vine diseases. During recent years, however, there has been a tendency amongst growers either to mix sulphur with copper containing dusts or to use copper containing dusts instead of sulphur. Under present-day conditions, copper containing sprays or dusts are obtainable with some difficulty, whereas sulphur is still procurable in fair quantities and at prices which compare very favourably with those of other fungicides.

Since 1933 sulphur has been included in a large number of experiments which have been carried out with a view to the control of different vine diseases. In general, the results of these experiments indicate that sulphur may rightly be considered as the most important fungicide at the disposal of the vinegrower. The different diseases included in these studies will be briefly discussed separately.

1. Botrytis or Gray Rot.

In many cases moderate applications of fungicides, particularly on the bunches at about three weeks prior to the colouring of the berries, had the effect of reducing botrytis storage rot of table grapes. It was found that on the whole the copper fungicides were more effective than sulphur; but the effectiveness of a copper fungicide, e.g., Verderame or copper oxy-chloride, was further improved by mixing it with sulphur in the proportions of 80 to 20 respectively. Even pure sulphur had a moderate diminishing effect on botrytis rot.

These applications should be directed particularly at the bunches from all sides and to such an extent that the appearance of the berries is not adversely affected.

2. Anthracnose.

It is accepted that this disease is controlled only with some difficulty and that the whole crop may in some areas be destroyed unless saved by timely applications.

It has been proved beyond doubt that a thorough winter spraying of susceptible vines with a suitable, strong fungicidal mixture is of the utmost importance for the reduction of the disease. For this purpose a lime sulphur solution (1 gallon in 8-10 gallons of water) or a copper sulphate solution (1 lb. in 2 gallons of water) is recommended. This spray should be applied about three weeks prior to budding. It is essential that the spraying should be thorough so that all the aerial parts of the vine from the tips of the bearers to soil level are well wetted with the fungicide.

During the growing season the vines should be thoroughly dusted or sprayed with some suitable fungicide. In the past, the belief was prevalent that copper containing fungicides such as Bordeaux mixture, Verderame and others, were distinctly better than sulphur. In some cases copper containing preparations were mixed with sulphur and sold as "copper sulphur". Sulphur not only proved to be nearly as effective against anthracnose as the copper containing dusts, but was found to be definitely more effective than the mixture of copper and sulphur. This means that the same result may be obtained at a much lower cost, because the copper fungicides are usually twice as expensive as sulphur.

In order to be effective, sulphur should be applied thoroughly, so that all the green parts of the vine are covered with a fine layer of the dust. For general guidance the following stages may be given at which applications should take place (*a*) when the shoots are about 10-12 inches long; (*b*) immediately after blossoming; (*c*) approximately three to four weeks after the second application.

If conditions still appear to be conducive to the disease, further applications may be given. Rainy weather particularly favours the extension of infection.

3. Powdery Mildew or Oidium.*

During recent years vine growers appeared to become rather doubtful regarding the effectiveness of sulphur for the control of the well-known Oidium disease of vines. For this reason several growers resorted to the use of mixtures of sulphur and copper or sulphur and lime. Some even thought of applying a winter spray in order to free the wood of the organism.

These problems were investigated during the past few seasons. The results of the investigations proved conclusively that sulphur remains the outstanding fungicide for the control of this disease. There is no doubt that sulphur is not only more effective than the more expensive copper compounds, but also distinctly better than the copper-sulphur mixtures. It was found contrary to the requirements for the control of anthracnose, that applications of concentrated dormant sprays had practically no diminishing effect on the disease and were definitely not profitable to use against oidium. For the control of this disease, therefore, the grower should rely solely on the summer dustings with sulphur.

It was furthermore clearly evident that lime had no effect on the disease. Where lime was added to sulphur, the effectiveness of the sulphur was reduced to the same degree. Where kaolin was used as a dilutive dust, the weakening effect on the sulphur was less marked. Even a 10 per cent. kaolin could be added to commercial sulphur without any diminishing effect on the fungicidal property of the sulphur.

Previous failures to control the disease with sulphur had generally been ascribed to a defect of the particular sulphur. Nine of the best known sulphur preparations were included in a comparative test. The results showed, however, that there is practically no difference between these various sulphurs and that all of them controlled the disease very satisfactorily.

This experiment clearly indicated, however, that the application of insufficient sulphur is the main reason for the troubles experienced in connection with oidium control. This inadequate application is mainly due to the belief that sulphur volatilizes under the influence of sunlight and heat and that the sulphurous gases exert the poisoning effect on the causal organism. It was therefore thought that a sporadic distribution of sulphur on the vine is all that is required for proper control. This belief, though not erroneous, seems to have led to the complete over-estimation of the effect of such dustings, with the result that the danger of epidemic outbreaks of the disease has been greatly increased. It has been proved that thorough applications of sulphur are an essential requirement for dependable results, as in the case with anthracnose. The vines should be dusted from all directions so that all green parts are covered with a fine layer of sulphur. Defective applications required further applications with

* A detailed report on this investigation has been drafted and submitted for publication as a scientific contribution.

poorer results. Three summer applications appear to be sufficient for many parts of the winter-rainfall area and should be given as listed for anthracnose.

It is important to remember in connection with the degree of application that the berries are most sensitive to sulphur burn during the period in which they are rapidly enlarging. The early applications should, therefore, be particularly thorough, while the latter applications should be more moderate. The berries are less susceptible to infection once they have started to soften, so that applications may then be stopped or need only be moderate if climatic conditions, conducive to the disease, still persist.

It was further found that sulphuring can be started before sunrise, provided that the vines are not too wet with dew. Sulphuring may then be continued until the heat is too intense or the wind too strong.

4. Isariopsis Leaf Spot.

This disease occurs in several vineyards of the winter-rainfall area and causes a considerable degree of premature leaf drop. Although the disease differs from oidium in many respects, the methods of controlling them correspond very closely. Dormant treatments have practically no diminishing effect on this disease, because its causal organism hibernates on fallen leaves.

Copper containing fungicides, especially Bordeaux mixture (4:4:50) applied during the summer at times as for anthracnose control yielded excellent results. If sulphur is applied carefully and timely, the results are however equally favourable. In this case also there appears to be little justification for using the more expensive copper containing fungicides, especially in view of the fact that sulphur is in any case the selected fungicide for Oidium and is already used regularly by the majority of growers. Here, too, the only essential requirement is that the sulphur applications should be judicious, but thorough.

5. Bacterial Blight (Vlamsiekte).

It should not be concluded from the foregoing, however, that sulphur will be effective against all diseases including bacterial blight. This is the one vine disease which is not readily controlled by the ordinary dusts or sprays. Like most bacterial diseases, "vlamsiekte" may spread in spite of the most careful treatments.

In vineyards where the disease is already present, the most susceptible varieties should be eliminated and replaced by less susceptible varieties. Furthermore, every precautionary measure should be taken to prevent its spread from infected to healthy vineyards.

In this connection the attention of farmers may once again be drawn to the importance of procuring only inspected and certified cuttings or vines for new plantings.

Summary.

From the above it is evident that the vine grower can practically safeguard himself by using sulphur correctly. All known vine diseases, with the exception of bacterial blight, can be controlled by sulphur. Furthermore, this fungicide has often been found to be equally effective against erinose, which is caused by an eelworm.

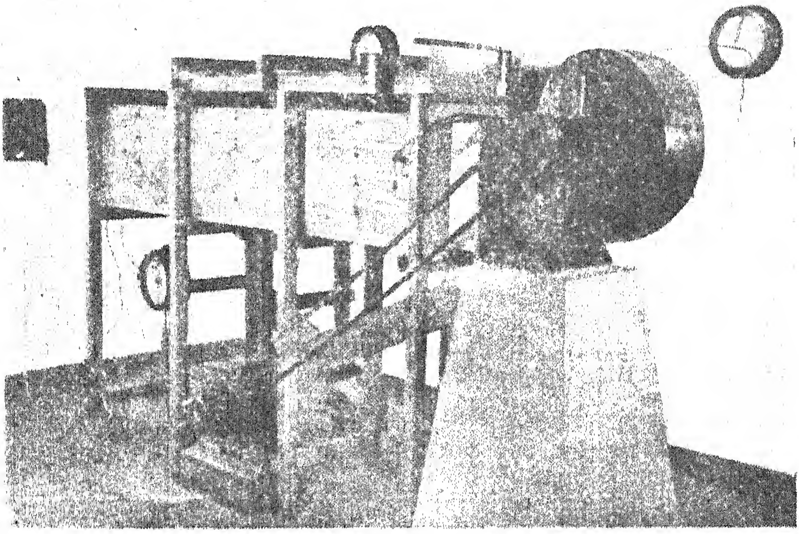
Where anthracnose occurs, it is important that a thorough winter treatment with a solution of lime sulphur or copper sulphate should precede the summer treatments.

Once again the importance of thorough sulphuring to ensure the perfect health of the vine should be stressed.

The Commercial Dehydration of Vegetables.

I. J. Burger, Fruit Research Institute, Stellenbosch.

LIKE fruit, most vegetables are seasonal products, all of which cannot possibly be consumed while fresh. If, however, the life processes of the vegetable can be slowed up or stopped entirely, the period during which such products are fit for human consumption is prolonged. This can be done by burying, cold storage, freezing, pickling, canning and drying.



Laboratory dehydrator at Fruit Research Institute.

The drying of foods is one of the oldest methods of preservation. Dried meats and dried corn were staple foods of the Indians, and "biltong" was probably the most popular form of preserved meat known to the Voortrekkers.

The process of drying can be adapted to almost all kinds of foods. It is estimated, for example, that in 1942, one out of every seven eggs produced in the United States of America was dried for shipment to the battle fronts. Similarly, large quantities of dehydrated milk are being produced, and great progress is being made in the production of dehydrated fruit and vegetable juices. It is stated that in the South African war, dried vegetables were used by the British Army; and the drying of certain kinds of vegetables is nothing new to the South African housewife. During the last World War, considerable quantities of dried vegetables were used, especially by Germany, where dehydration was used extensively. That country is said to have had 36 plants at the beginning of the war, and about 1,900 at the end of the war.

Following the last war, however, all efforts to popularise dried vegetables amongst the civilian population met with very little

success, and the dehydration of vegetables failed to develop into a primary industry. The main reasons for this failure were lack of palatability of dehydrated vegetables, loss of odour, colour and vitamins during drying and storage, and failure to refresh in water in a short time.

The objectionable qualities of dehydrated vegetables were largely due to faulty methods of preparing and drying these products. It has been shown, for example, that the enzyme, *peroxidase*, is responsible for undesirable changes in colour, odour, flavour and texture of certain kinds of dehydrated vegetables. Enzyme activity is also responsible for loss of vitamins during drying and subsequent storage. If these enzymes are inactivated immediately after preparing and before drying the vegetables, a large proportion of the vitamins and the nutritive values are retained, and the final product is of sufficient palatability.

The enzymes peroxidases, which are very necessary to the normal life of plants, but damaging to their quality if permitted to continue activity after harvesting and storing, are inactivated by heat during the blanching process. This blanching or partial pre-cooking stops all life processes and also hastens rehydration and preparation for serving. Blanching is conducted in boiling hot water, or in live steam. The hot water blanch is less desirable than steam blanching, because much of the mineral soluble substances and the water soluble vitamins are dissolved in the hot water.

In hot water blanching, the prepared vegetables are placed in baskets and immersed in a vat of boiling water for a period of 3 to 5 minutes, and then spread on trays.

For steam blanching, the prepared vegetables may first be spread on trays, and the trays of vegetables may then be subjected to live steam for the required period of time, depending on the vegetables used and the size of the pieces.

Quality of the Vegetables.

As no form of preservation can improve the quality of the raw product, it is of the utmost importance to use good quality vegetables. High quality dehydrated foods can be made only from high quality raw material. Only certain varieties can be successfully canned, and similarly only selected varieties are suited for dehydration. They must be grown properly, and must be harvested at the correct stage of maturity, and the freshly harvested vegetables must be delivered promptly to the drying plant.

At this plant the vegetables are washed, sorted, trimmed, peeled, cored, sliced, diced or shredded, blanched and dried without undue delay. Most vegetables are dehydrated to approximately 5 per cent. moisture content, and immediately packed in air tight containers.

Future Prospects.

Some vegetables contain as much as 90 per cent. of moisture, the removal of which results in a shrinkage in volume, and reduction in weight, which are two very important factors in modern transport. A comparison frequently made is that one ship can carry as much food value in dehydrated products as nine or more ships could, of

commodities in their natural form. The following table given by Prof. Cruess offers a very interesting comparison :—

Comparison of Weight of Dehydrated Vegetables and of Canned from One Ton Fresh.

	Weight prepared for Canning and Dehydration.	Weight Canned and Packed.	Weight Dehydrated and Packed.
	lb.	lb.	lb.
Cabbage	1,450	2,400	215
Tomatoes	1,100	1,760	125
String Beans	1,500	3,832	200

The volume can be further reduced by compressing the dehydrated products into the smallest possible space. This in its turn means a considerable saving of containers as compared with packed fresh or canned products. Furthermore, in modern warfare products must be able to withstand severe weather conditions, often under exposed conditions.

All these factors stress the importance of food products in a concentrated form. As a result of to-day's knowledge of food technology, which permits of the concentration of vegetables by means of dehydration under controlled conditions of humidity, temperature and air velocity, combined with modern knowledge of packing and storing, the dehydration of vegetables, like other food products, appears due for an important revival.

To-day it is possible to produce a bone-dry dehydrated vegetable that will keep, and when cooked, cannot be distinguished from the fresh product. In 1942 the production of dehydrated vegetables in the United States of America was estimated to amount to 30,000,000 lb., as compared with 15,000,000 lb. during 1941 and 6,000,000 lb. during 1940. At an average drying ratio of 8 : 1 the 1943 production of dehydrated vegetables represents 120,000 tons of fresh vegetables.

As customary methods of preservation are restricted by lack of tin, rubber and packing material, canners are interested in the possibility of dehydrating vegetables, and research workers in all parts of the world are aiming to improve varieties, methods of preparing, drying, packing and storing, in order to make possible the production of dehydrated vegetables which are palatable and nutritious.

Drying of Fruit.

I. J. Burger, Fruit Research Institute, Stellenbosch.

THE drying of fruit is not only the oldest, but also the most important means of preserving one of nature's best products.

Improved cold storage facilities have prolonged the life of fresh fruit, and other methods of preservation have been introduced, but in spite of all these developments the commercial world-production of dried fruits (excluding dates) during the past 30 years has remained at a constant figure of approximately 1,000,000 tons annually. This means that each year approximately 5 million tons of fresh fruit is kept off the world markets during the fruit season, and distributed later in the dried form.

FIG. I.—Drying Yard.

During the expansion of the dried-fruit industry, the methods of drying gradually improved. Originally the only means of removal of the moisture from the fruit was by means of sun-drying, which implies drying without artificial heat. While this was the only means of drying available, the expansion of the industry was restricted by the climatic conditions of the fruit-growing countries. Then followed evaporation by means of artificial heat, but with the circulation of the air depending on natural draught. This method of drying permitted the drying of fruit such as apples, which are normally produced in regions where sun-drying is inefficient.

Eventually the artifically heated air was mechanically circulated. In this method, which is termed dehydration, the temperature, humidity, and the air circulation are all rigidly controlled. This makes possible the drying of certain kinds of fruit which deteriorated during the process of sun-drying or under unfavourable weather conditions. Dehydration furthermore prolongs the drying season and by decreasing the drying period greatly improves the quality of certain kinds of dried fruit, and largely eliminates the drying risks, as well as the infestation of the dried product by insects, etc.

As no method of preservation can improve the quality of the fresh product, it is of the utmost importance to use good quality fruit for drying. Codling-moth infested fruit, for example, when dried is either unfit for human consumption or an uneconomic proposition when trimmed so as to conform to the health regulations. If the fresh fruit is immature or badly bruised, the resulting dried product will be of inferior quality. Immature apricots attain a dark dull appearance, and every 1 per cent. increase in sugar content of grapes represents approximately a 5 per cent. gain in weight of raisins. Similarly the size of cut fruits, prunes and figs, etc., largely determines the grade of the final product. The approximate relationship between the size of fresh apricots and the size grade of dried apricots is demonstrated by the following comparison:—

No. of fresh apricots per lb. to produce a—

4-diamond dried apricot, 10.
3-diamond dried apricot, 14.
2-diamond dried apricot, 18.
1-diamond dried apricot, 30.

In addition to the extra expense of cutting 30 small apricots instead of ten large ones, the small apricots contain three times the

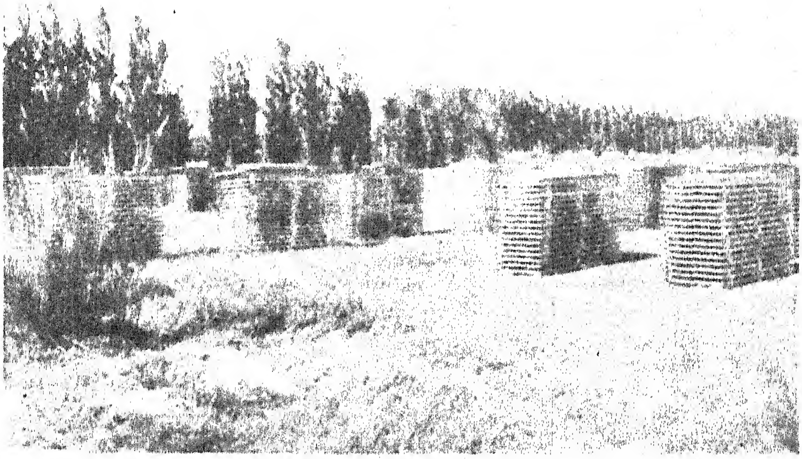


FIG. 2.—Stacking Trays.

number of stones; the dried product weighs less and is worth only half the value of the higher grade.

Harvesting the Fruit.

With the exception of pears, which are picked green and ripened off the tree before drying, fruit intended for drying is harvested when sufficiently ripe to give optimum yield, flavour and quality. In most cases this represents the degree of ripeness desired for eating the fresh fruit. Pears are thoroughly treated for the removal of all arsenical spray residues.

Pears, peaches, plums and apricots are cut in halves; the core and calyx removed from the pears and the stones from the other

fruits. Prunes and some grapes are dipped in a dilute lye solution in order to remove the waxy bloom from the fruit.

Before drying, some fruits are sulphured to prevent subsequent discoloration of the fruit during the drying process and storage.

Drying Methods.

As a detailed description of the drying methods for the various kinds of fruit would be too lengthy, an outline of the procedure followed is listed below:—

Fruit.	*Pretreatment.*
Apricots	Cut, stoned, sulphured.
Peaches	Cut, stoned, sulphured.
Plums	Cut, stoned, sulphured.
Nectarines	Cut, stoned, sulphured.
Pears	Spray residue removed, ripened, cut, steamed, cored and sulphured.
Figs	Sulphured.
Hanepoot grapes:	
(i) Muscatel	No treatment; berries should be attached to bunches.
(ii) Cluster Raisins	Lye dipped; berries must remain attached to bunches.
(iii) Loose Raisins	Lye-dipped; berries removed from bunches after drying.
Sultana grapes:	
(i) Naturals, or Thompson's Seedless	No treatment.
(ii) Bleached Sultanas	Lye-dipped and sulphured.
(iii) Unbleached Sultanas	(a) Hot-lye dipped and sun dried. (b) Cold dipped, shade dried and sun bleached.
Currants	No treatment; preferably shade dried.
Prunes	Lye dipped and preferably dehydrated.
Apples	Peeled, sliced, sulphured and dehydrated.

Detailed information concerning sulphur houses, or other aspects of fruit-drying, is obtainable from the Director, Western Province Fruit Research Institute.

The Black Peach Aphid and its Control:—

[Continued from page 461.

volume. One lb. of soap should now be added to each 20 or 25 gallons of extract and spraying should be commenced without delay.

In hilly orchards or where water is difficult to obtain, nicotine dust may be used instead of spraying. Dusting operations should be carried out in warm still weather when no dew or rain is present on the trees. Most commercial knapsack or rotary dusters are suitable, unless very large trees are to be treated. High grade dusts, containing 4 per cent. nicotine are recommended for the control of the black peach aphid; although more costly than lower grade materials, they will give proportionately better results when correctly applied.

A NEW BULLETIN FOR THE SHEEP FARMER.

Bulletin No. 236 "Cactus and Oldman-saltbush as Feed for Sheep" has recently been published. The Bulletin is obtainable from the Editor of Publications, Pretoria, at 6d. per copy.

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 JUNE 1943 No. 250

CONTENTS

* Price Review for April, 1943.

SLAUGHTER STOCK.—Prices of slaughter cattle improved much during the latter half of the month, especially that of the better classes, so that the average prices for April in general were somewhat higher than for March. Ordinary primes on the Johannesburg market were 60s. 8d. per 100 lb. estimated dressed weight *on the hoof*; good average were 55s. 8d. and compounds 43s. 4d. In the case of slaughter sheep the strong demand was maintained and prices rose further. Prime Merinos on the Johannesburg market were 12d. per lb. estimated dressed weight as against 11·5d. in March and prime crossbreds were 9·5d. as against 9d., while on the Cape Town market prime merinos were 12·4d. per lb. as against 11·7d. in March and prime crossbreds 11·6d. as against 11·1d.

Foodstuffs.—Supplies of lucerne and teff hay were greater than during March but prices changed little or nothing. Oat hay was exceptionally scarce.

Potatoes.—Supplies were still large but decreased quickly from the middle of the month as a result of the wet weather and prices rose sharply. Transvaal consignments were still predominant on the markets. On the Johannesburg market National Mark Grade 1, No. 2 and 3 were 15s. 8d. and 15s. per bag respectively as against 13s. 1d. and 12s. 7d. the previous month, while on the Cape Town market Cape No. 1 rose from 8s. 4d. to 13s. in April and Natal No. 1 on the Durban market from 13s. 9d. to 14s. 7d.

Onions.—Small supplies Cape onions towards the end of the month caused prices to rise somewhat everywhere, e.g., Cape onions on the Johannesburg market from 11s. to 12s. 10d. per bag and on the Cape Town market from 7s. 8d. to 9s. 10d. per bag.

Vegetables.—Larger supplies cauliflower, cabbages, green peas and green beans reached the markets, while pumpkins were also still present in large quantities. For the rest, vegetables on the whole were scarce and dear.

Fruit.—Consignments deciduous fruits decreased appreciably during the month so that towards the end only sales of apples and to

* All prices mentioned are averages.

some extent pears were still of importance. Prices of all kinds gradually rose. The supply of tropical fruit also decreased much, especially that of pineapples. Supplies pawpaws and grenadellas, however, increased and prices hereof on the whole weakened.

Supplies navel oranges increased much on the markets except on the Cape Town market where it was less by nearly half that of the previous year. This was as a result of the step taken by the Citrus Board in Cape Town since the middle of April, viz., to market all citrus fruits under its control at the citrus depot at fixed wholesale and retail prices. Prices on all markets decreased and navel oranges were 3s. 4d. per bag for National Mark grades on the Johannesburg market and 2s. 11d. for ordinary navels while on the Cape Town market it was 5s. 3d. per pocket and 3s. 3d. on the Durban market.

Eggs.—Eggs were very scarce and prices everywhere increased sharply, e.g., new laid on the Johannesburg market from 2s. 9d. to 3s. 3d. per dozen and on the Durban market from 3s. 2d. to 3s. 11d.

Index of Prices of Field Crops and Animal Products.—This index, as shown elsewhere, again increased during April, viz., from 145 the previous month to 148. The most important increases occurred: (i) in the group "Other Field Crops", viz., from 119 to 140, mainly caused by the rise in prices of potatoes; (ii) poultry and poultry products, viz., from 216 to 262 as the result of the scarcity of eggs. The other groups all changed very little or nothing.

Prices of Maize and Maize Products for the 1942/43 Crop.

Prices of all maize and maize products have again been fixed for the present season, beginning 1 May 1943.

Producers' Prices.—The following are the prices at which producers must sell:—

	Grades 2, 4 *and* 6.	*Grades* 3, 5 *and* 7.	*Grade* 8.
In bags	16s. 0d.	15s. 10d.	15s. 7d.
Ex Elevator	15s. 3d.	15s. 1d.	14s. 10d.

These are free-on-rail prices senders' station.

Consumers' Prices.—Up till 31 August 1943, the consumer will pay 18s. 3d. per bag for grades 2, 4 and 6; 18s. 1d. per bag for grades 3, 5 end 7 and 17s. 10d. for grade 8. Railage and other transportation costs are to be paid by the buyer and are not included in these prices. The corresponding prices where maize is sold *ex* elevators will be 1s. 3d. per 200 lb. less in each case.

The above prices include a levy of 3d. per bag which each trader has to pay to the Maize Control Board for each bag of maize delivered by him.

Furthermore, maximum consumers' prices as well as maximum millers' prices have been fixed for all kinds of maize products.

After 31 August 1943, all consumers' prices will be increased by 1d. per bag for each month.

Seed Maize.—Since there are no grades for seed maize a minimum price of 18s. 6d. per bag has been fixed in this case.

For full particulars regarding the buying and selling of mealies and mealie products during the present season see the *Government Gazette Extraordinary* of 30th April 1943.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON (1st July to 30th June).	Summer Cereals. (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Stock. (e)	Dairy Products. (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
WEIGHTS.									
1936-37	19	13	2	3	34	6	17	6	100
1937-38	118	86	94	93	122	86	89	98	106
1938-39	89	106	112	118	98	112	105	107	101
1939-40	92	107	96	89	79	102	106	94	93
1940-41	86	106	77	93	116	105	106	89	104
1941-42	109	113	106	159	103	108	110	112	109
	121	132	145	205	101	131	134	163	124
1942—									
January	131	137	126	180	100	122	144	141	125
February	132	138	125	168	101	130	140	147	125
March	126	140	140	175	101	130	134	168	125
April	126	139	151	170	102	130	129	175	125
May	158	139	188	181	102	154	132	203	136
June	159	139	207	186	101	154	140	218	138
July	159	140	183	184	166	167	154	163	143
August	159	139	181	175	115	167	155	130	140
September	159	139	182	191	115	167	176	133	145
October	159	139	156	227	115	167	181	141	147
November	160	154	134	189	115	139	187	146	147
December	160	154	123	137	115	139	178	158	144
1943—									
January	160	154	132	113	115	139	165	150	141
February	163	154	130	112	115	139	156	179	142
March	161	154	142	119	115	139	160	216	145
April	159	154	142	140	116	139	163	262	148

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay.
(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins.
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls, turkeys and eggs.

* Preliminary.

Index of Prices Paid for Farming Requisites.

Year and Month.	Implements. (a)	Fertilizers. (b)	Fuel. (c)	Bags. (d)	Feeding Stuffs. (e)	Fencing Material (f)	Dipping and Spraying Material. (g)	Building Material. (h)
Base—								
1936-38	100	100	100	100	100	100	100	100
1939	105	106	98	146	90	114	100	103
1940	120	139	117	171	95	176	112	124
1941	124	170	124	175	109	208	115	144
1942—								
January	121	146	125	188	115	229	117	164
April	122	146	134	194	127	228	117	165
July	124	146	146	220	147	231	118	167
October	124	146	152	224	145	230	118	171
1943—								
January	126	146	154	232	145	238	123	174
April (j)	126	146	154	233	148	238	123	176

The following is the composition of the above groups. (The items are weighted according to their respective importance) :—

(a) Ploughs, planters, seed drills, harrows, cultivators, ridgers, mowers, binders-hay rakes, silage cutters, hammer mills, separators, windmills, shares, land sides, mouldboards, knife, pitman, guard.
(b) Superphosphate, ammonium sulphate, potash, muriate, bonemeal.
(c) Petrol, power paraffin, crude oil, grease, lubricating oil.
(d) Woolpacks, grain bags, sail twine, binder twine.
(e) Mealies, bran, oats, lucerne, groundnut-oil cake, bonemeal, salt.
(f) Fencing wire, standards, baling wire.
(g) Bordeaux mixture, lime sulphur, arsenate of lead, cyanogas, Cooper's sheep dip, Little's dip, Tixol cattle dip.
(h) Corrugated iron, deals, cement, lime, flooring boards.
(j) Preliminary.

Average Prices of Slaughter Cattle and Pigs.

SEASON (1st June to 31st May).	BEEF PER 100 LB. (a) Johannesburg.				(b) Durban.		PIGS PER LB. LIVE WEIGHT. Johannesburg.		
	N.M. Prime.	Ordinary Prime.	Good Medium.	Compounds.	Medium.	Compound.	Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938–39	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940–41	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941–42	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942—									
January	62 3	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
October	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2
April	65 6	60 8	55 8	43 4	42 1	33 11	6·9	9·1	6·5

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

SEASON (1st June to 31st May).	JOHANNESBURG. Merino Wethers.		Persians and Cross Breds.		CAPE TOWN. Merinos.		Capes and Persians.	
	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.	Prime.	Medium
	d.	d.	d.	d.	d.	d.	d.	d.
1938–39	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940–41	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941–42	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942—								
January	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March	9·6	814	8·8	7·9	9·6	8·8	9·3	8·8
April	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
October	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·4
February	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·1
March	11·5	9·8	9·0	7·3	11·7	10·6	11·1	10·2
April	12·0	10·2	9·5	7·7	12·4	10·9	11·6	10·8

* As sold on the hoof. Reported by Meat Control Board.

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[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Some Hints on Onion Planting.

V. Reinecke, Horticulturist, and Geo. C. Haines, Entomologist.

SOIL intended for onion planting should not be deeply dug or ploughed just before planting. The deep digging or ploughing should be done some months before the planting season, or if this was done for the previous crop, shallow working of the soil just before planting is sufficient.

Onions are fairly heavy feeders, and therefore require a fertile soil to give the best results. On impoverished or light sandy soils the results are unsatisfactory. An application of well-rotted manure or of compost at the rate of 20 tons per morgen, or a bushell of it per 10 square yards, plus superphosphate at the rate of 800 lb. per morgen or about 1 lb. per 10 square yards, can be recommended. If manure or compost is unobtainable, then fertiliser mixture F., at the rate of 1,200 lb. per morgen, or about 1½ lb. per 10 square yards, may be applied. If the soil is naturally acid or has previously been continiously worked and irrigated, then an extra dressing of agricultural lime should be applied at the rate of 2 tons per morgen, or about 4 lb. per 10 square yards. All the above-mentioned fertilisers, manures, or lime should be worked into the top six inches of soil.

Preparation of the soil by thorough ploughing early in the season is also a very important factor in cutworm control. If the lands have been weedy, do not plant the crop immediately after ploughing, since such lands may be full of cut-worms, which are almost certain to attack the plants. If possible, plough the land early and thoroughly, and leave it absolutely fallow for about six weeks before planting the crop. If this cannot be done, and it is suspected that cutworms are present, bait the lands with a cutworm bait after the ploughing and when the weeds have dried up. Directions about cutworm control and the preparation of baits will be supplied by the Chief, Division of Entomology, Box, 513, Pretoria, or the nearest Government Entomologist.

Care should be taken with regard to depth of planting. If the plants are planted too deep, development of the bulb will be retarded due to the pressure of the bulb against the soil, especially so in the case of clayey soils. Where such soils are allowed to become dry during the bulbing period, the bulbs will be malformed. Planting furrows should not be deeper than two inches, for if made deeper, there will be a possibility of airspaces being left beneath the plant roots, and this will result not only in retarded growth, but also in the sinking of the plants to a lower level after the first irrigation.

On poor soil, the plants should be spaced from 4 to 5 inches apart in the rows and on fertile soil, which has received the necessary manures and or fertilisers, the spacing should be about three inches. Before planting, the roots of the plants should be trimmed back to ½ inch, and these plants should then be placed to a depth of half inch below the surface, and loosely covered with the soil which has been removed from the furrow, and then firmly pressed down with the sole of the shoe.

Planting should preferably be done after a rain when the soil is still moist, or late in the afternoon, as a scorching sun is detrimental for the immediate development of the plant.

 [*Continued on page* 509.

FARMING IN SOUTH ... AFRICA

Vol. 18 JULY 1943 No. 208

Editorial:

Erosion on Grazing Lands.

About ten years have elapsed since the introduction of the various anti-erosion schemes under which the Government provides both technical and financial assistance to landowners who are concerned about the erosion of their lands and who wish to take steps to combat the menace. Throughout the country advantage has been taken of the facilities offered, and excellent results have been obtained. Most attention was, however, devoted to the reclamation of parts of the veld which were already eroded, and to the control or prevention of further erosion on lands.

The most important result achieved during the decade under review is the greatly increased general interest now being taken in the problem of soil erosion, not only by the farming community whose existence is directly threatened, but also by the urban population which is now beginning to realize that it is likewise affected and that soil erosion is an enemy within the gates, menacing its existence as well.

What is not fully realized as yet, however, is that prevention is better than cure. It is of the utmost importance that tracts of land already affected by active erosion should be saved from total destruction and restored to their original productive condition. Too little attention is still being given to the factors or causes leading to this condition of active and clearly perceptible érosion.

For a better realization of the underlying causes of soil erosion, and especially erosion of ploughed lands, it is essential to bear in mind (*a*) that part of the rainwater which falls on the surface of the soil is absorbed by the roots of plants and utilized for growth; (*b*) that another part sinks into the sub-soil to replenish the lower-lying water supply which emerges again in the form of springs or is pumped up from boreholes and (*c*) that the remainder does not soak into the ground, but runs off the surface into pools, pans, marshes and dams, any water left after that being borne to the sea by way of spruits and rivers.

Of all the various parts mentioned, namely that which is absorbed by plants and got rid of again in the process of transpiration, that which evaporates from the surface of the soil, that which emerges again as springs, and that which flows along spruits and rivers to reach the sea, a certain amount continually evaporates to form clouds from which the water is precipitated again as rain. There is therefore a natural water cycle.

In so far as soil erosion is concerned, that part of the rain-water which runs off the surface, is of the greatest importance. In the natural and undisturbed condition of the veld, the amount and distribution of run-off water is such that no abnormal erosion takes place. If, however, something should happen to increase the amount and rate of run-off at a certain point or in any particular direction, a dangerous position arises, since more soil will then be taken up in suspension and swept away.

In the natural course of events the run-off is regulated by the extent and density of the vegetal cover and the capacity of the soil to absorb water rapidly, because if the ground is densely covered with vegetation, the rate of run-off is checked, both the aerial and subterranean parts of the plants serving to protect the soil. The soil itself is also maintained in an absorptive condition so that water readily soaks in. In such circumstances very little erosion takes place, but if as a result of certain disturbances the vegetal cover should deteriorate or the rapid absorptive capacity of the soil should be impaired, more than the normal quantity of water will run off and the rate of run-off will also be accelerated. This is where the trouble starts. An ever-increasing amount of the surface layer of soil is washed away by the water. The most serious aspect of the matter is that once the process has started, it gradually assumes graver proportions. It is the beginning of a vicious cycle, which, if not checked in good time, will lead from bad to worse. Everything therefore works hand in hand. At first more water runs off, i.e., less soaks into the ground for the use of plants, with the result that less water is available for growth. The chances that a still greater quantity of water will run off after the next rain are therefore increased, as is the danger that more soil will be swept away, and so one evil aggravates the other. In the initial stages the process is so insidious as to be almost imperceptible, but as the loss of top-soil over the whole area gradually increases, the effects of surface erosion become only too apparent and the run-off water is concentrated along definite channels, such as footpaths, and dongas begin to form. From this stage onwards the process is greatly accelerated until eventually the entire area is perfectly drained by a ramified system of large dongas and their numerous tributaries.

The question which now arises is: What actually causes the deterioration of the vegetal cover of the veld to such an extent that it results in accelerated and increased run-off and, consequently, abnormal erosion? The answer to this question is now known because deterioration of veld is definitely the result of incorrect methods of utilization, e.g., overstocking of a particular part of a farm and consequently over-grazing, trampling and general misuse. In the high-rainfall areas incorrect utilization of the veld does not lead to immediate erosion since the destruction of useful plants due to overgrazing is usually followed by the appearance of inferior plants so that, despite the decline in grazing value, the veld nevertheless remains comparatively well covered with vegetation, but in the extensive low-rainfall areas of the country erosion immediately sets in since mismanagement of the veld soon reduces the density of the vegetal cover.

The obvious conclusion therefore is that the solution to the problem of soil erosion lies in the application of methods of veld management which will prevent the deterioration of veld. The fundamental principles regarding the correct utilization of the various types of veld in this country are known; they merely await practical application whereby the veld, the soil, the grazing animal and the farmer will all greatly benefit.

The same applies to arable land. The methods of veld utilization, which will prevent erosion and ensure permanent productivity, are known. They only await application.

(Dr. J. C. Fick, Senior Professional Officer, Division of Soil and Veld Conservation.)

Poisoning of Animals by Algae on Dams and Pans.

Dr. Douw G. Steyn, Onderstepoort.

SINCE the end of December, 1942, an unknown disease has occurred at Vaaldam, causing severe losses among cattle and sheep. Even dogs died, and fish were also found dead at the waterside.

The veterinary officers investigated the disease and found it to be similar to a disease which occurred round a pan in the Wakkerstroom district in 1942. This disease, which had caused the death of cattle which had drunk from the pan, was attributed to a poisonous kind of algae found in the pan. Horses, cattle, sheep, mules, hares and even water birds were found dead round the pan. After the pan had been fenced off, losses among stock stopped immediately. Unfortunately, something went wrong with the suspected water sent to Onderstepoort and no reliable experiments, could therefore be made to prove that the infected pan water was poisonous.

All the farms on which this unknown disease occurred and still occurs, are adjacent to the Vaaldam. This applies particularly to farms situated at points where the water from the Vaal River and Wilge River overflows the banks into vleis and pans. Experiments carried out with this polluted Vaaldam water at Onderstepoort and Vaaldam proved:—

(*a*) that this algae-infested water is very poisonous;

(*b*) that fresh, growing algae are poisonous and that the poison is discharged into the water when they die;

(*c*) that the process of decay reduces the toxicity of the algae and that decayed algae, dried in the sun, are much less poisonous than the original fresh algae;

(*d*) that the toxicity of polluted water is diminished by boiling it for a quarter of an hour;

(*e*) that animals to which the polluted water was given, showed the same symptoms and post-mortem lesions as cattle, sheep and dogs which had died at the Vaaldam.

Description of the Algae.

During calm and warm weather the algae, which are fairly dark green in colour, float on the surface of the water in dense layers. When the weather is boisterous, the waves mix the algae with the water to such an extent that nothing is visible on the surface, but whenever some of this water is taken from the dam, a few small plants of the algae can be seen floating in it. In stormy weather the algae may be found twenty feet and more under the surface of the water. Apparently the algae are also inclined to sink down deeper when the water is cold, so that hardly any of them are then visible on the surface. These algae are nothing more than minute granular waterplants, the individual groups of which are no larger than a pinhead, and sometimes even smaller. Miss E. L. Stephens, of the Department of Botany, Cape Town, identified the algae as *Microcystis flosaquae* (Wittr) Kirchn, which belongs to the group of blue-green algae (*Myxophyceae*). All the species of algae referred to in this article were identified by Miss Stephens. Conditions favourable to the growth of algae are:

(1) warm, dry and calm weather;

(2) sunlight, and

(3) broad and stagnant stretches of water (inundated pans and vleis).

The algae grow luxuriantly where large numbers of submerged trees or shrubs starts decaying.

This process of decomposition evidently provided the necessary food for the algae. In fact, most of the trouble has been caused where trees and shrubs have been inundated by the dammed-up water of the Vaaldam.

After a few days of dry, calm and sunny weather, large masses of algae float in dense green masses on the water. The slightest breeze is sufficient to drive the dense floating masses of algae to the edge of the dam or pan, where the water becomes very poisonous. This explains why mortality among stock so often coincides with certain winds. So, for example, one day animals die on the western side, and on the next deaths occur on the northern, southern or eastern side of the dam or pan, depending on the direction of the wind which caused the algae to drift to the edge of the water. After the wind has driven the algae into creeks and inlets in dense masses and has died down again, the minute plants die and decay, producing a beautiful range of colours. The decomposition of the mass of algae is accompanied by the emission of a most obnoxious stench which can be detected at a considerable distance from the dam, and which at times becomes so intolerable that the doors and windows of farm houses have to be closed. The green colour of the fresh algae first changes to light blue which then deepens into dark blue. After further decomposition a dark purple colour spreads over the surface of the thick soggy masses in the cracks of which a dark red liquid, like the water in which beetroot has been boiled, may be seen. If this red liquid is filtered and poured into a beaker or glass tube it fluoresces, i.e., when seen from above the liquid is red, but when seen from different angles with the light shining through the beaker or tube, it displays a number of colours—red, purple, blue. If this fluorescent liquid is acidified, it loses its colour, and becomes clear like water, but if it is alkalized again the red fluorescent colour returns.

Since the algae require fairly warm weather for luxuriant growth there is a considerable reduction of the quantity of algae present on the Vaaldam during the winter months, and as stated above, the algae are inclined to sink in the water during cold weather. Several farmers near the Vaaldam have, however, assured us that even in winter the algae lie in thick layers on the water in sheltered spots.

In the United States of America and in Australia the species of algae found on the Vaaldam has for many years been suspected to be the cause of mortality among stock.

Poisonous Constituents of the Vaaldam Alga.

This alga appears to contain two toxic substances, viz.,

(1) one affecting especially the central nervous system and the liver, and

(2) the other causing lesions of the skin.

This alga undoubtedly contains one of the most potent and destructive liver poisons known. In peracute cases of poisoning the liver cells are almost completely destroyed within a few hours. The red purplish blue fluorescent fluid in the algae was isolated by Dr. Polson of Onderstepoort, and is phycocyan. As a result of the

damage to the liver, this pigment reaches the blood and absorbs the ultra-violet rays of the sun, causing burns on the skin.

Mr. P. G. J. Louw and Dr. C. Marais of Onderstepoort are engaged in isolating the liver poison from the alga, and have already made good progress with the work.

Symptoms and Post Mortem Lesions Caused by the Vaaldam Alga.

Depending upon the quantity of algae which the animals drink, the symptoms may be classified as peracute, acute and subacute, and chronic (prolonged).

In peracute (rapidly developing) cases the animals are usually either found dead near the water, or they die within a few hours of sickening and showing signs of convulsions, which closely resemble those of strychnine poisoning. In other cases no convulsions are observed, but the animals begin to tremble and soon succumb to a rapid and fatal general paralysis.

In acute and subacute cases the symptoms are very similar to those described above, but the animals live for about two weeks. Owing to the severe damage to the liver, jaundice is common in such cases, and the animals fall off considerably in condition. The muzzle, udder, ears and parts of the skin of affected animals show signs of inflammation.

The muzzle is often so tender that the animals cannot graze, while the udder and teats of cows become so painful that they will not allow their calves to drink, and milking naturally also becomes very difficult. It is mostly the white portions of the skin which are affected, but in serious cases even dark-skinned animals are affected. The inflamed muzzle and skin swell, become very tender, and after a day or two show cracks from which pus drains. This pus then dries, as does the affected skin, which becomes hard and hairless. After a time the dried skin cracks and falls from the body, leaving large ugly sores which make it extremely painful for the animals to walk. In many cases the back of the ears is also affected. In the initial stages of this skin affection animals may often be seen swaying their heads or rubbing them against something and, if their legs are affected, they kick or stamp their feet. In many cases the skin around the eyes is also affected, and when the animals have partially recovered, the hairless rings around their eyes look like spectacles.

Usually animals are inclined to be constipated, and the hard faeces are generally covered with a bloody slime.

Chronic cases closely resemble subacute cases, but the animals may remain sick for weeks or months before they die or recover. The most characteristic symptoms are emaciation, poor appetite and the abovementioned skin lesions. It stands to reason that the milk production of cows will decline or even cease altogether. If animals ingest small and non-fatal quantities of algae, the only outward sign of poisoning in the case of cows, for example, is a reduction in the milk yield and a falling off in their condition. Young animals become lean, listless and do not grow well.

An interesting feature is that animals suffering from some deficiency (e.g., pregnant animals and dairy cows) show a tendency to walk into and to eat the decaying algae, as in the case of animals which are inclined to eat bones, rags, etc. The better the type of dairy cow, the greater is the quantity of water which she drinks. This explains why the mortality is always higher among such animals than among dry cows.

Post-mortem lesions.—In peracute cases the lungs are usually full of blood, the liver enlarged and dark red, even black, in colour,

the spleen enlarged, and coagulated or uncoagulated blood is present in the abdominal cavity. The liver is very brittle, sometimes even flabby, and thick, sticky, blackish blood flows from the surface of an incision from which the liver cells may easily be scraped like pulp. Usually nothing much appears to be wrong with the stomach and intestines, but bloody patches may sometimes occur on the mucous membrane of these organs, and congealed blood may be found in the intestines, especially in the large intestine.

In cases where the progress of the disease is slower, a yellowish or bloody liquid is usually found in the pericardium, thorax and abdominal cavity. The liver is yellow and very soft or brittle, or brownish yellow and hard in cases where the animal was sick for weeks or months.

Diseases which may be Confused with Alga-Poisoning.

It is obvious that in the various stages described above this disease may be confused with anthrax, gallsickness (transmitted by ticks), lamsiekte, senecio poisoning, and poisoning by toxic substances which cause sensitiveness to light (photosensitivity), e.g., geel dikkop in sheep, etc. If animals die suddenly the farmer must also bear in mind the possibility of such diseases as gousiekte and gifblaar poisoning in areas where these poisonous plants occur. In all cases blood smears should be sent to the Government Veterinary Officer concerned, or to the Director of Veterinary Services, Onderstepoort.

Treatment of Cases of Alga-Poisoning.

There is no specific remedy known and, consequently, the symptoms must be treated as such. Since affected animals are inclined to be constipated, especially in the rearmost part of the large intestine, it is advisable to give them a lukewarm soapwater enema. A large cow or horse can take 3 to 4 gallons of soapwater at a time, and a sheep 3 to 4 pints. It is recommended that a little olive oil, peanut oil, cottonseed oil, linseed oil or liquid paraffin should be well stirred into the soapwater. Also administer purgatives and heart stimulants.*

The skin lesions must be treated with raw linseed oil or, better still, with carron oil, and, since the burns are really due to the sun, it is of great importance that such animals should be kept in the shade as much as possible.

Affected animals should be given succulent green feed (young green lucerne, green oats, barley, etc.), especially if their muzzles are affected. Such feed can be consumed without causing much pain, is readily digestible and will also counteract the constant threat of constipation. Green feed, however, contains a constituent, chlorophyl, which is converted into a substance called phylloerythrin in the stomach of the ruminant, and this also causes burns on the skin if the affected animals are exposed to the sun. It must therefore be stressed once again that animals suffering from alga poisoning should be kept in the shade. They may, however, be allowed to graze early in the morning or late in the afternoon.

It is also good to give affected animals thick barley water or meal water to drink.

Prevention of this Disease.

As a temporary measure the animals should be kept away from water infested with this poisonous alga, but since flowing water, wind and waterbirds can spread the alga, it is also essential, of

* See *Farming in South Africa*, August, 1941 (Reprint No. 70, 1941).

[*Continued on page 510.*

Factors Influencing the Vulnerability of Merino Sheep to Blowfly Attack.

A. H. de Vries, Entomologist, Grootfontein College of Agriculture, Middelburg, C.P.

THE sheep blowfly has recently again attracted a good deal of attention, and this widespread public comment is fully justified by the extent of the damage done by this pest and the ominous increase in its incidence.

Extent of Blowfly Damage.

In order to give the reader some idea of the losses annually sustained by this country as a result of blowfly damage, the main contributory factors are briefly sketched in the following paragraphs.

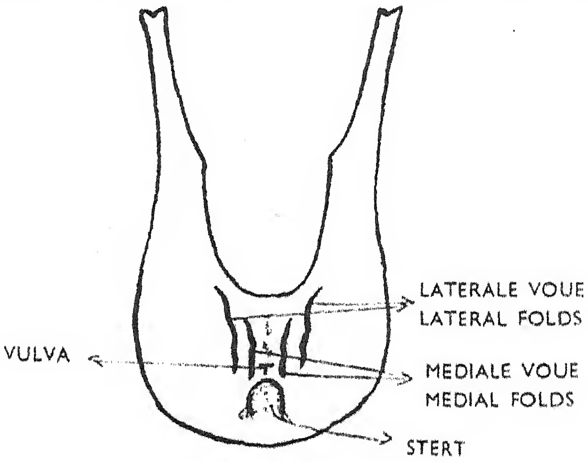

Fig 1.

Labour.—During concentrated attacks sheep must be brought together, crutched and treated, and the affected parts shorn. These operations demand the attention not only of all available hands on the farm but sometimes also of additional labourers who must be hired for the purpose, as well as of the farmer himself. Consequently other essential work on the farm is neglected with resulting indirect loss to the farmer.

Wool and other losses.—Crutching, clean-shearing and maggot damage result in heavy losses in wool. Serious blowfly infestation not only causes a break in the wool but also retards the development and growth of young sheep.

The continuous driving and handling of the sheep causes large quantities of dust, sand and other foreign matter to lodge in the wool and means unnecessary trampling of the veld and acceleration of the processes of erosion.

Lamb Crops and Mortality.—Ewes and rams suffering from blowfly strike will not breed—a factor which often accounts for the low lamb crops. In addition, many sheep, often the most valuable animals in the flock, die as a result of blowfly infestation.

To the foregoing must be added the cost of setting and tending traps, destruction of carcases and the remedies required for the treatment of affected sheep.

The pecuniary loss involved in these various items of damage cannot be accurately assessed, especially in view of the fact that the attacks are not always, or in all parts of the country, equally severe.

In spite of all such difficulties, however, it has recently been calculated that the annual loss amounts to £1,500,000—a colossal figure for a small country like S.A.—which leaves no doubt that the blowfly is one of the most destructive insect pests which harass the agricultural industry of the Union.

There is no reason for despair, however, for although the pest is serious, as is now fully realized, the position is not hopeless.

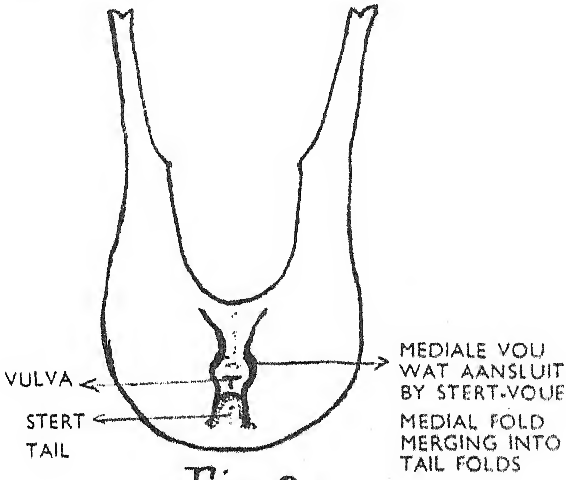

Fig 2

It is an encouraging fact that considerable progress has recently been made in the field of research. The main object of all research work is to devise completely successful methods for the protection of sheep against blowfly infestation, i.e., to reduce the susceptibility of sheep and consequently also the number of attacks.

In this article a description is given of the main factors causing vulnerability. Subsequent articles will deal with antidotes and the plans for final elimination of this evil.

During the past five years observations have been made at this Institution on the susceptibility of sheep. In some cases sheep ranging from the most developed to the most plain-bodied types were specially selected for this purpose.

Detailed descriptions were made of the various features of the animals used in the experiments, such as development (especially with regard to folds in the crutch), length and type of tail and condition of vulva. Detailed descriptions were also made of conformational features, such as broad or narrow hindquarters, drooping or goose-rump, cow-hocks, etc. Many photographs were taken and individual records were kept for years with a view to determining whether sheep which proved to be susceptible in one season remained vulnerable.

Blowfly activity and environmental factors, especially climatic conditions, such as changes in humidity, temperature and rainfall, were studied. Since no full discussion of all the results obtained can be included in this article, only the more important findings and conclusions will be briefly mentioned.

Vulnerability to Blowfly Attack.

One of the chief causes of susceptibility is the presence of moisture which penetrates the wool and keeps the skin moist for some time.

Although it is to-day generally accepted that sheep of the developed type are more susceptible, it is not yet fully realized that the plain-bodied animal may, in certain circumstances be equally vulnerable. Its chances of becoming infested are, however, smaller, as will appear from this article.

It has been proved that it is impossible for blowfly eggs to hatch in dry wool on any part of a sheep's body, and equally impossible for live maggots, which are placed in such spots, to survive. Should the skin on any part of a sheep's body be moistened, however, and kept wet for some time, conditions favourable for the hatching of eggs and survival and growth of maggots are created, i.e., a sheep can artificially be made susceptible by the creation of conditions favourable for the parasite. It has also been found that blowflies are attracted to such an artificially moistened spot on the sheep's body and lay their eggs there. At this Institution desiccated eggs have been found in the crutches of sheep which were not infested. The natural conclusion is that the animal must have been attractive (susceptible) with the result that eggs were laid, but that the skin became dry and consequently "insusceptible" before hatching of

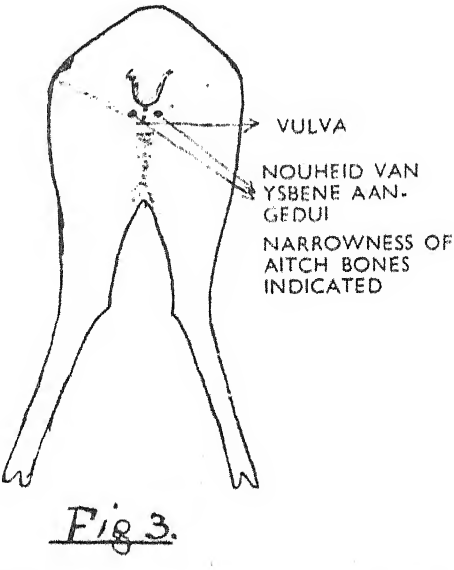

Fig 3.

the eggs which, in the absence of moisture, dried out and became unhatchable.

If wetness is accepted as one of the main predisposing factors, the chief causes of wetness may be summarized as follows:—

(*a*) Skinfolds, (*b*) conformation, (*c*) abnormal vulva, (*d*) length of tail and skin development on the tail.

Skinfolds.

The term of development signifies skinfolds on the body of the sheep. There are, however, various degrees of development, and we can, therefore, speak of highly developed, less developed and plain-

bodied sheep. In the case of plain-bodied animals it must be noted that, if a sheep has neck folds, its crutch will generally also show folds, however small. Such an animal is often regarded as being plain-bodied, but although such a condition represents a great improvement on the other types, especially from a blowfly-control point of view, a plain-bodied sheep is, in my opinion, one which shows no development at all, particularly in the crutch region.

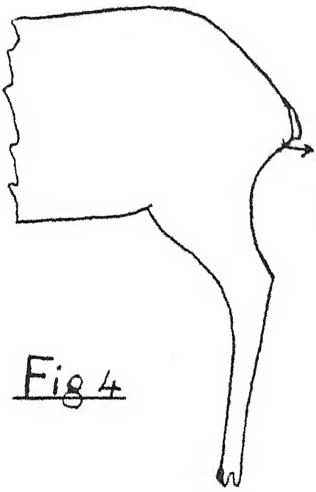

Fig 4

The main folds appearing in the crutch are the following:—

(1) Two folds running down the crutch, one on each side of, and usually near, the anus and vulva. These are termed the medial folds (Fig. 1).

(2) Two lateral folds usually running parallel with, and along the outer sides of, the medial folds (Fig. 1).

Many sheep have both types of folds, and they are usually very susceptible. Others, again, have only one of these pairs of folds. Those which have only the lateral folds are usually less susceptible than those having both pairs or only the medial folds, unless the animal happens to be very narrow between the aitch-bones. In some cases the medial folds join other folds on the tail, and in such circumstances the animal is also very susceptible (Fig. 2).

(3) In addition there may be transverse folds which, if they join the abovementioned folds, make the position still worse, since they form cavities which, when wetted, remain moist for a very long time.

(4) Folds occurring on the tail will be discussed later.

Medial and lateral folds are not necessarily disadvantageous in themselves, provided they are not so near the vulva as to enclose it and to prevent the sheep from urinating freely. This accounts for the fact that sheep with such folds often remain free from blowfly strike.

As soon as the wool covering the folds reaches a certain length—especially if the posterior conformation of the sheep is narrow or if the folds occur near the vulva—the animal urinates against the wool and the consequent splashing of urine gradually wets the entire crutch region. The wool, which is continually wetted in this way, finally becomes hard and then chafes and irritates the vulva as the

animal moves about. In course of time the vulva becomes affected to such an extent as to render normal urination impossible. This point is discussed in greater detail under (*c*).

Not only does the wool on the folds become hard as a result of this continuous wetting, but the skin itself becomes raw. In many cases this condition progresses to the point where the wool can be pulled off together with the skin. Wounds caused in this way are usually septic and often suppurative, so that blowflies are quickly attracted.

Folds about two inches below the vulva do not affect susceptibility unless they are wetted on account of poor conformation, as already indicated.

It is clear, therefore, that folds in the immediate vicinity of the vulva are most undesirable and may prove to be very harmful.

(*b*) Conformation.

Conformation has a very important bearing on susceptibility and in this connection three points call for special attention:—(i) narrowness between the aitch-bones—a condition usually accompanied by cow-hocks (Fig. 3); (ii) drooping or goose-rump (Fig. 4); (iii) the size of the bare area surrounding the anus and vulva.

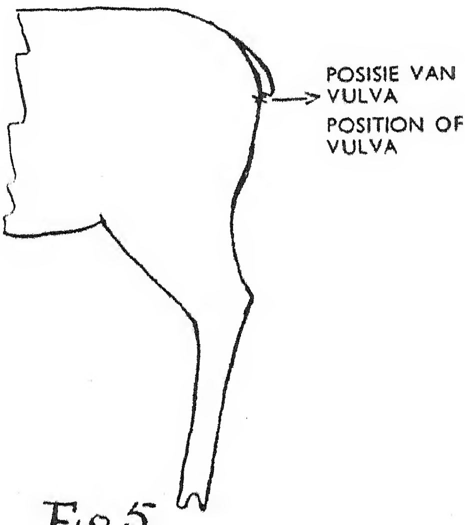

Fig 5

These three features are sometimes closely correlated, since narrowness between the aitch-bones and a drooping rump are often found in animals with a very small bare area around the vulva.

A narrow posterior in a sheep denotes a somewhat roof-like rump and poorly fleshed, tapering hindquarters. (Fig. 3).

Where the aith-bones (*tuberischii*) are closely set, little space is left between the tail, vulva and anus. In such animals the opening between the aitch-bones leading to the pelvic girdle, as well as the excretive organs and the surrounding bare area will also be small.

As soon as the wool reaches a certain length, it practically covers the anus and vulva, so that the sheep urinates against the wool and wets herself, as already explained under (a).

Compare Fig. 4, which illustrates the drooping or goose-rump, with Fig. 5, in which the animal shows a fine top-line and a smooth and vertical posterior. In some animals of the latter type, the hindquarters are so well fleshed that, when viewed from the side, the tip of the vulva can be seen. Such an animal urinates away from her body and never wets herself. On the other hand, ewes of the goose-rump type are always wet, often down to their hocks. Worst of all, these ewes remain wet underneath, probably because the sun is prevented from reaching those parts by the overhanging rump. (Compare the positions of the vulva in Figures 4 and 5).

Since the area of bare skin around the anus and vulva is small in narrow-rumped sheep but large in animals with good conformation, the latter type alone is suitable for breeding purposes. Just as undesirable folds in the face can be removed by selective breeding, a larger bare area may be obtained around the anus and vulva by the application of selective methods of breeding. The larger this area, the less obstruction will be experienced in urinating.

(c) Abnormal Vulva.

This defect, which is of such widespread occurrence in mature sheep, has as yet not received much attention. It is, however, one of the chief causes of a wet crutch and consequent susceptibility in sheep. Unskilled shearers are often blamed for cutting off the tip of the vulva, whereas in reality it rotted off early in the sheep's life.

A normal vulva is provided with a long, narrow, soft, fleshy tip which acts as an open duct. The natural advantage of this bodily

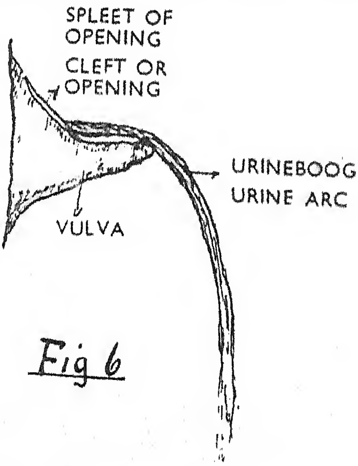

Fig 6

structure is that the ewe is enabled to urinate in an arc away from the body (Fig. 6).

If the ewe has medial or lateral folds, as explained under (*a*) or has a narrow posterior as described under (*b*), then, as soon as the wool reaches a certain length, the sheep will begin to wet it. The resultant hardening of the wool, and other effects have already been referred to. The urine further irritates the chafed skin of the vulva, and the wounds soon begin to fester. Scabs are formed, especially on the tip, and the condition becomes aggravated since the urine is splashed over the scabs and causes further wetting of the surrounding wool. The softened scabs are rubbed off, new scabs form, further festering and wetting occur, and finally the tip of the vulva is completely destroyed.

The first stages of this process have been noticed in lambs barely two months old. In one group of lambs between 4 and 5 months old, a few were discovered in which the tip was all but rotted off. It should be pointed out that in this case the lambs had previously been crutched once, but that special care had been taken not to injure the tip of the vulva. In the cases referred to above, the vulvae were abnormally swollen as a result of irritation. All these lambs were of the type illustrated in Fig. 2, i.e. extreme cases. When they were inspected they had been crutched a few days before and consequently their wool was very short. In spite of this fact, the wool was soaking wet. This proves that even at this stage the lambs

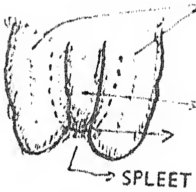

Fig 7

were permanently mutilated and that no crutching or operation could ever remedy the defect.

It should be clear, now, that the vulva may be affected early in the life of the ewe and that many lambs, when being shorn for the first time, may be found to have lost the tip of the vulva. In such cases the shearer cannot be blamed.

Abnormality of the vulva is, therefore, the main cause of wetting, which, in turn makes an animal vulnerable to blowfly attack. Cases of sheep born with an abnormal vulva are very rare. One form of such abnormality is a twisted opening which results in wetting of one side of the crutch.

(*d*) Length of Tail.

In a fairly large percentage of cases, blowfly attacks, even on the well-built and plain-bodied types, are undoubtedly due to the fact that the animal has a short or split tail. In one group of experimental ewes, predominantly of the plain-bodied type, no less than 70 per cent. of the attacks were at one time due to this defect. (In this connection it may be mentioned that, while this article was being written, the same group of sheep was examined for blowfly infestation and two cases were discovered—the first of blowfly strike since the winter and the recent rains—both animals having become infested at the tips of their short tails. The sheep were shorn about two months ago).

The explanation is that the tip of the short tail reaches only as far as the anus or just above it. As soon as the wool on the tail attains a length of half an inch to an inch, it covers the vulva and is consequently wetted. The result is that such sheep are attacked at the tip of the tail. A sheep with a short tail never lifts it when urinating, as a sheep with a longer tail (4 in. e.g.) invariably does. When blowfly infestation spreads, as it usually does, over the rump,

it is a sure indication that it started at the tip of the tail, especially at the time of a severe general attack.

In many sheep it is common to find that folds develop on the tail. Docking of such tails leads to most peculiar forms of tail-growth, of which rose, horse-shoe and split tails are the best known. It is especially the latter type of tail which makes an animal extremely vulnerable, since the wool growing in the split is not easily dried. (Fig. 7).

In certain high-rainfall areas of the Union, sheep are also attacked on the body. In continuously rainy weather, the moisture ultimately penetrates to the skin of the animal, for example, on the rump, back, shoulders and the back of the neck. This happens, especially, in the case of sheep with loose wool and a poor conformation. If conditions remain warm and the sky overcast for long periods, so that no evaporation and consequently no drying can take place, the animals become susceptible and are attacked. In such cases too, developed sheep are more vulnerable since drying between the folds proceeds more slowly than on a plain skin.

Summary.

By way of summarizing, it may once more be emphasized that the chief cause of susceptibility to blowfly strike in sheep is wetness which penetrates to the skin and keeps it damp for some time.

This wetness largely originates in the sheep itself, the causal factors being:—

1. Poor conformation, i.e. drooping or goose-rump, narrowness of aitch-bones and too small a bare area or space around the anus and vulva.
2. Skinfolds, especially near the vulva.
3. Defects of the vulva, which may arise very early in the sheep's life due to the defects mentioned under (1) and (2).
4. Severe docking of the animal's tail.

The elimination of these defects from present and future flocks will be the subject of subsequent articles.

Nursery Quarantines.

The following nursery quarantines were in force on 1 June 1943:—

(1) Page's Nurseries, Franschhoek, C.P., on citrus (all), for red scale.

(2) Beaulieu Nurseries, Forestdale Siding, P.B. Grahamstown, C.P., on citrus (all), for red scale.

(3) Municipal Nursery, Randfontein, on palms (all), for circular purple, Ross and Spanish red scales.

A Popular Bulletin for the Farmer.

Bulletin 234.—"-Re-inforced Circular Reservoirs." Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria, at 3d. per copy.

Draw up your own Farm Inventory.

Dr. S. P. van Wyk, Department of Agricultural Economy,
Stellenbosch-Elsenburg College of Agriculture.

THE factors of production of an agricultural enterprise include not only inanimate and animate instruments, but also movables and immovables which are used in the process of production. The life of some of these is, relatively speaking, of longer duration, because they are employed in more than one production process while others participate in only one production effort. The creation of greater utility which is the characteristic feature of production, is accompanied by depreciation, wear and tear and the destruction or the transfer of value of the factors of production.

A farmer must, therefore, continually make provision for the replacement of the value of those instruments of production which are destroyed in the production process, and in consequence must constantly seek to meet the costs resulting from such renewals. If this is not done, his instruments of production will become exhausted to such an extent that a maladjustment will result between the capital value of the instruments with a longer life and those which are rapidly consumed in the process of production.

To-day the farmer experiences the greatest difficulty in successfully coping with this danger. His products may realize exceptionally good prices but his capital goods are also more expensive and, in addition, extremely difficult to obtain. He cannot buy all the implements he would like to acquire; spare parts are almost unprocurable; fertilizers are so scarce that a special permit is required for their acquisition, and the demand for labour is so great that it can hardly be satisfied.

The difficulty of the farmer's task is greatly accentuated by the very nature of farming itself. The major part of his annual outlay goes towards capital expenditure on buildings, irrigation facilities, etc., the value of which decreases each year. Then there are the orchards which require constant attention and continually drain his funds. There are also the herds in which the time and capital of several generations may have been invested in order to raise them to their present level of development. If, therefore, the farmer were at this juncture to neglect his farming enterprise, the resultant damage would not only be incalculable but almost impossible to repair. It is unthinkable that the fertility of his soil, which has been improved by the application of scientific methods, should now be allowed to be destroyed again by overstocking, erosion and methods of exploitational cropping.

This might so easily happen under the present circumstances if the farmer carries on without due regard to the constituent parts of his enterprise. Depreciation, exhaustion and destruction of the instruments of production are such gradual, imperceptible and constant processes that many farmers are unaware of what is going on and suffer a rude awakening when it is already too late.

Utility Value of Instruments of Production.

The only way in which the farmer can avoid the shock of such a discovery is to draw up an inventory or list of his possessions which will enable him to give an account of his stewardship. This will facilitate the control of the use and maintenance of the instruments of production in use in his farming enterprise. The first step in taking an inventory is to make a count of the assets. Although

this may admittedly have its value, the basis of the whole system of keeping account of the constituent parts of the farming enterprise is to assign a definite value to every item, a value which corresponds as closely as possible to the usefulness of the relative item on the inventory. In this case the value of the instrument of production is reflected by its usefulness. The cost of maintaining the instruments of production is determined by the rôle which each one plays in the enterprise and the difficulties experienced in its replacement. In theory it is quite sound to-day for a farmer to base his inventory valuation on price or cost, but in practice this is of dubious value unless the goods are actually sold.

The importance of valuation is based on the fact that it enables the farmer to ascertain the function fulfilled by each instrument of production in the production process and, consequently, provides an indication of the amount of attention and cash which may be devoted to it. Secondly, the farmer can deduce therefrom the contribution made by each item to the capital strength of his undertaking and the amount it will cost to replace it. These replacement costs are reflected by the productivity of the relative item on the inventory, and provide an indication of the expense to which the farmer will have to put himself in order to maintain it in good working condition or, when this is no longer practicable, to acquire another. Thirdly, the farmer can readily calculate his annual depreciation and determine from that what steps he must take to reduce this to a minimum by economic repairs and more effective utilization of his means of production.

Profitability of the Farming Enterprise.

Not only must the farmer's possessions or assets be taken into consideration, but also his debts and obligations, and liabilities. By comparing these the farmer can see whether he is solvent or insolvent. He can determine whether his capital strength has increased during the financial year or not. Any change in his net capital strength is a matter of the greatest moment. The interpretation of the change in capital strength is of the utmost importance for the profitability of the enterprise. It does not necessarily follow that the farmer has made progress if he has reduced his debts. True, it may indicate that he is in a financially sounder position, but this might have resulted in a maladjustment between his fixed and working capital owing to his having sold some of his sheep in order to pay off part of his debts. It might very well have been a productive debt which was discharged in this uneconomic manner. Such a step will definitely hamper the future productiveness of his enterprise.

Very often a farmer sells some of his breeding stock because prices appear unusually high. His cash reserve is thereby increased or with the proceeds he purchases land at an exorbitant price. On paper there has been an apparent increase in his capital strength but actually the productive capacity of his enterprise has been reduced. His net worth has therefore increased but his future total net income has been restricted in the process.

Just as the inventory is the basis of every system of bookkeeping, so it is also the keystone of any successful farming enterprise. Not only must the farmer know what every item on the inventory is worth to him, but also what its replacement will cost. He must calculate what the annual depreciation is so that proper provision can be made to counteract any possible hampering effect which that depreciation might have on his farming activities. A comparison of the different groups of the inventory will enable any maladjustment which may

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Breeding and Feeding Experiments with Ducks.

P. J. Serfontein, Professional Officer (Poultry), Potchefstroom College of Agriculture.

DUCK-FARMING is a branch of poultry-farming which has received comparatively little attention in the scientific world, and until recently no feeding and breeding experiments had been carried out with ducks in South Africa. Interest in this branch of farming is, however, increasing by the day, and consequently investigational work has been commenced. A simple feeding cost experiment has brought to light some interesting and hitherto unobserved data.

For this experiment, four breeds were used, viz., Aylesbury, White Muscovy, Pekin and Khaki-Campbell. For record purposes, and with a view to future research, it may be mentioned here that the Pekins at this Institution are the descendants of English and German Pekins, imported by Messrs. Oswald Symons and Heiman, respectively. The Khaki-Campbells were originally obtained from the Grootfontein College of Agriculture, and there is a possibility that, at some time or other they were crossed with Buff Orpingtons.

Feed Consumption.

All the data and observations available up to date were derived from this experiment . The ducks were fed the following rations up to the age of 10 weeks.

TABLE I.—*Constituents and Composition of Rations.*

Constituents.	Ration.					
	1.	2.	3.	4.	5.	6.
Yellow mealie meal	70	60	60	60	60	60
Pollard (wheaten)	20	—	—	—	—	—
Wheaten bran	15	—	—	—	—	—
Ground oats	10	15	15	15	15	15
Lucerne meal	5	10	10	10	10	10
Meat meal (80% protein)	18¾	15	9	—	—	—
Fish meal (concentra)	—	—	—	12¾	12¾	13
Soybean meal (raw)	—	—	—	30	—	30
Soybean meal (cooked)	—	—	—	—	30	—
Bonemeal	2	2	3	1	1	4
Powdered oyster shell	2½	3	2	3	3	2½
Salt	½	½	½	½	½	½

The composition of the rations was as follows:—

Proteins	19·94	19·94	16·5	20·00	20·00	20·2
Ca	1·72	1·76	1·68	1·72	1·72	2·07
P	0·62	0·53	0·63	0·68	0·68	0·93
Fibre	3·82	4·82	5·1	5·5	5·5	5·4

Each duck on the different rations was weighed separately every week. The birds were reared in cold brooders and were fed on a moist mash twice a day.

Since the rate of growth of ducklings may vary at different times of the year, the hatching dates of each group are given in Table II.

TABLE II.—*Quantity of feed consumed and weight increase.*

Ration.	Date of Hatching.	Breed.	Original Number.	Average Weight at 8 Weeks.			Average Feed Consumption.	Average Weight at 10 Weeks.			Average Feed Consumption.	Percentage Mortality. 10 Weeks.
				Males.	Females.	M. and F.		Males.	Females.	M. and F.		
				lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	
1	13/10/41	Pekins..........	18	3·77	3·28	3·62	12·65	4·84	3·90	4·48	18·38	31·5
2	13/10/41	"	18	3·26	2·37	3·05	12·31	4·15	4·58	4·10	21·46	38·8
2	28/10/41	"	25	2·22	2·69	2·50	10·82	3·14	3·46	3·40	20·00	55·0
3	28/10/41	"	24	2·12	2·66	2·37	7·88	2·97	3·20	3·13	17·10	20·8
4	14/11/41	"	21	2·99	3·33	3·17	8·29	3·53	3·91	3·63	16·00	37·5
5	28/11/41	"	31	2·86	3·24	3·11	9·71	4·43	4·47	4·46	16·20	16·1
6	12/12/41	"	15	3·12	2·74	3·07	11·28	4·09	3·36	3·97	16·2	31·1
2	28/10/41	Khaki Campbells	12	2·00	2·33	2·17	12·69	2·91	2·73	2·99	17·20	25
2	28/11/41	" "	16	1·75	2·23	2·07	10·70	3·12	3·04	3·06	16·54	50
4	28/ 1/42	" "	7	2·50	3·20	2·87	10·00	2·99	3·48	3·21	16·30	50
2	7/ 2/42	Muscovies.......	20	3·06	2·33	2·85	13·4	4·74	3·66	4·42	22·2	0
2	16/11/42	Muscovy x Pekin	9	4·10	3·36	3·96	14·91	5·33	4·76	5·23	23·05	22·2
2	3/12/42	" "	9	3·83	3·44	3·68	15·56	5·58	4·74	5·27	24·8	11·1
2	15/12/42	" "	9	3·79	4·51	4·15	20·25	5·90	5·04	5·38	27·93	0

The above weights for Pekin ducks are by no means satisfactory. It must be remembered, however, that these are average figures; the groups were very small and mortality very high. In addition, there are ducks in every group which did not reach a weight of two pounds at the age of ten weeks. On the other hand, some of the Pekin drakes weighed 6 lb. at the age of ten weeks. This unsatisfactory increase in weight may be due to the low feed consumption, which in turn, may have been caused by the type of hopper used. Ducks are voracious feeders and crowd together around the hoppers, trampling the feed until it becomes so dirty that they refuse to eat it.

The most acceptable explanation, however, may be that the ration was deficient in some nutrient. The highest average feed consumption was 21·46 lb. and the highest average weight 4·48 lb., as compared with the average oversea figures of 30 lb. feed up to the age of ten weeks, with an average weight of more than 5½ lb.

Hatching Results.

For the past eight years it has been observed that the hatching results of duck eggs are very poor and gradually grow worse; particularly during the latter part of summer. A possible reason for this may be that ducks, being such voracious feeders, put on too much fat. With a view to testing this out, two pens of mated Pekins were used. In pen A the hoppers were always kept filled, but in pen B the feed was limited to 5 ozs. per duck per day. All birds received the following laying mixture.

Yellow Mealiemeal	60 lb.
Ground Oats	10 lb.
Lucerne Meal	15 lb.
Meat Meal (80 per cent. protein)	15 lb.
Powdered Oyster Shell	4 lb.
Bonemeal	1 lb.
Salt	½ lb.

The composition of the ration was as follows: Crude proteins 20·03 per cent., calcium 1·96 per cent., phosphorus 0·41 per cent., and fibre 5·60 per cent.

A Group of Pekin Ducks.

The following was the average egg production on the above ration (the eggs being used exclusively for hatching purposes):—

TABLE III.—*Egg-production on Special Laying-mixture.*

Month.	Pekin Pen A.	Pekin Pen B.	Khaki-Campbells.	Aylesburg.
1941—				
July........................	0·44	0·55	1·40	0·00
August.....................	14·20	7·40	12·40	6·50
September..................	21·20	16·20	16·60	19·50
October.....................	21·80	13·20	14·20	14·50
November...................	16·00	11·60	12·00	14·50
December...................	12·70	7·50	14·80	12·20
1942—				
January.....................	8·60	5·30	16·10	4·50
February....................	2·00	4·10	13·50	1·25
March.......................	7·80	2·10	2·80	2·50
April........................	—	—	—	—
May.........................	—	—	—	—
June.........................	—	—	—	—
Average production for year.....	103·74	67·74	121·80	73·45

Some of the ducklings hatched out in the spring came into production in April, but stopped laying very soon after.

Each drake was mated with three ducks and the hatching results were as follows:—

TABLE IV.—*Hatching Results.*

PEN A (Pekin).

Date of Hatching.	Eggs put in.	Infertile.	Dead Embryos.	Dead in Shell.	No. Hatched.	Percentage Hatched of Total Eggs.
10/10/41.......	77	20	9	15	33	42·8
28/10/41.......	81	23	5	16	37	45·6
14/11/41.......	96	30	27	15	24	25
29/11/41.......	65	14	12	15	24	36
11/12/41.......	40	8	2	16	14	35
6/1/42.........	34	20	6	5	3	8·8
27/1/42........	49	38	1	5	5	10·2
10/3/42........	21	17	3	1	0	0
TOTAL..........	463	170	65	88	140	—
Percentage......	—	36·7	14·0	18·7	30·3	—

PEN B (Pekin).

Date of Hatching.	Eggs put in.	Infertile.	Dead Embryos.	Dead in Shell.	No. Hatched.	Percentage Hatched of Total Eggs.
10/10/41.......	38	22	2	5	9	23·6
28/10/41.......	63	29	7	14	13	20·6
14/11/41.......	48	29	7	3	9	18·7
29/11/41.......	44	23	10	7	4	9·0
11/12/41.......	30	14	5	8	3	10·0
6/1/42.........	39	33	1	4	1	2·5
27/1/42........	34	30	—	2	2	5·8
10/3/42........	29	20	8	1	—	0
TOTAL..........	325	200	40	44	41	
Percentage......	—	61·5	12·0	13·5	12·6	—

KHAKI-CAMPBELLS.

Date of Hatching.	Eggs put in.	Infertile.	Dead Embryos.	Dead in Shell.	No. Hatched.	Percentage Hatched of Total Eggs.
10/10/41.......	28	12	1	7	8	28·5
28/10/41.......	53	28	4	9	12	22·6
14/11/41.......	44	23	5	5	11	25·0
29/11/41.......	56	17	10	8	21	37·4
11/12/41.......	29	7	7	7	8	27·6
6/1/42.........	79	56	4	11	8	10·1
10/3/42........	66	56	4	5	1	0·01
TOTAL..........	355	199	35	52	69	—
Percentage......	—	56·0	9·8	14·6	19·4	—

AYLESBURY.

Date of Hatching.	Eggs put in.	Infertile.	Dead Embryos.	Dead in Shell.	No. Hatched.	Percentage Hatched of Total Eggs.
10/10/41.......	17	5	2	6	4	23·5
28/10/41.......	44	12	6	15	11	25·0
14/11/41.......	27	7	7	8	5	18·5
29/11/41.......	26	11	4	7	4	15·4
11/12/41.......	10	3	3	1	3	30·0
6/1/42.........	28	22	2	3	1	3·5
10/3/42........	5	5	—	—	—	0·0
TOTAL..........	157	65	24	40	28	—
Percentage......	—	41·4	15·2	25·4	17·8	—

The average monthly weights of the various groups of ducks were:—

Month.	Pekins Group A.	Pekins Group B.	Khaki Campbells.	Aylesbury.
	lb.	lb.	lb.	lb.
June	5·72	6·35	4·62	6·88
July	6·63	7·10	4·98	7·21
August	6·05	6·82	4·42	5·95
September	6·05	6·58	4·84	5·54
October	6·75	5·81	4·42	5·85
November	5·86	5·80	4·69	6·43
December	5·82	5·75	4·45	6·60

According to the above figures, those Pekins (pen A) which received an unlimited quantity of feed yielded the highest average production and also achieved the best hatching results. The poor results are, therefore, not due to the quantity of feed given but must be sought in the breeding and in the type of feed.

Abnormalities in Ducks.

Three types of abnormalities occurred during the feeding experiments. The first was a type of beak-deformity, which became apparent from the age of about three weeks. The beak assumed a flat appearance and curled in at the sides. Cases of this nature occurred on all rations and were more common later in the season.

The second abnormality was a leg deformity. In affected birds the legs became bent outwards at the heel, giving the duck a bandy-legged appearance. Although cases of this type were observed on all rations, the greatest percentage occurred in group No. 1, which received raw soybean meal. A case which closely resembled perosis in chicks occurred in this group.

The writer is inclined to ascribe both deformities to the calcium-phosphurus ratio in the rations. The rations used and generally recommended for ducks are ordinary chicken rations. It should be remembered, however, that the rate of growth in ducklings is about four times as great as in chickens. It can, therefore, be assumed that a duckling's calcium and phosphorus requirements are much higher. In those groups in which a higher percentage of calicum and phosphorus was fed, an improvement was discernible, but the groups were small and consequently not satisfactory.

A third very common abnormality occurred in the wings. In some cases only one wing was affected, in others, both. This abnormality may be described as a slip wing rather than as a split wing, as this condition occurs in fowls. A slip wing in fowls is a wing which is not held properly in position when folded. A split wing, on the other hand, shows a definite opening between the secondary and primary feathers. In the case of affected ducks there is no such opening, although the wing is not folded properly.

Since this abnormality occurred in all breeds and affected such a high percentage of birds, without any sign of it in the parent bird, it may be assumed that it is not hereditary. The following table reflects breeds and numbers which developed wing abnormalities.

This type of wing abnormality occurred in both sexes. It is noteworthy that the largest percentage occurred in the Pekin-Muscovy cross, which showed the most rapid growth. On the other hand, it also occurred in Pekins which weighed as little as 2·58 lb. at the age of 10 weeks as against Pekins which weighed 4·83 lb. at the same

Breed.	Number.	Normal.	Left Wing abnormal.	Right Wing abnormal.	Both Wings abnormal.	Total abnormal Wings.	% abnormal Wings.
Pekins	104	94	4	5	1	10	9·6
Aylesbury	7	5	1	—	1	2	28·5
Khaki Campbells	43	27	2	10	4	16	37·2
Pekin x Muscovies Crosses	21	7	4	2	8	14	66·6
Muscovies	8	7	-	1		1	11·2

age. Even the Pekin Muscovy crosses which had the lowest weights in the group, viz., 4·88 lb. at the age of 10 weeks, showed the same abnormality as, for example, the cross which weighed 6·10 lb.

Injury must not be excluded as a possible cause. Water birds are very clumsy and nervous and may easily be injured during the weighing process, without its being noticed. The abnormality also occurred, however, in ducks which were not weighed at all.

Feather-eating in Ducks.

Feather-eating occurred on all the abovementioned rations. Where soybeans were used, however, its incidence was smaller. This pica was very severe early in the season. Feather-eating is a trouble with which duck-farmers generally have to contend, and one which has very injurious effects. Ducks are slaughtered at the age of ten weeks, and it is important that the plumage should be full at that time, since this gives the bird an attractive appearance, facilitates leaning, and serves as a protection for the skin. Ducks which have fallen a prey to feather-eating are unattractive in appearance, especially if bare patches are present, and the cleaning of such a carcase is very difficult.

When feather-eating was at its worst, wood shavings were thrown into the pens and were eagerly consumed by the ducks. The result was that feather-eating diminished. Later in the season, however, it was observed that the ducks were refusing the shavings.

Stunted Ducklings.

In every group of ducks and on all rations there are always one or more ducklings which develop very poorly from the third week onwards. These ducklings remain stunted, their eyes are always watery, and eventually black rings develop around the eyes. At the age of 10 weeks, when other ducks weigh 4·50 lb., these stunted birds weigh only 1·86 lb.

At the age of ten weeks these ducklings are in an exceedingly weak condition; they experience difficulty in walking and standing, their necks are bent and they spend most of the time lying stretched out on the ground. They usually die before reaching the age of 16 weeks. Specimens of such ducklings have been sent to Onderstepoort for examination, but no cause could be determined. Apparently it is a hereditary characteristic which may be eliminated by individual pedigreeing.

Fading of Pigmentation in Pekin Ducks.

It has repeatedly been proved that certain physiological factors in fowls can be correlated with production in the past. Most important of these factors are pigmentation and moulting, followed to a lesser extent by body capacity and handling quality.

In fowls, pigmentation and fading in themselves are valuable factors in determining the length of a hen's production period. Pigmentation is, however, a determining factor only in breeds showing a slight yellow coloration of the beak and legs. This pigment is known as Xanthophyll and is produced by such feeds as yellow maize and greenfeed. In non-producing birds this pigment accumulates in the skin and in the adipose tissue below the skin. As soon as production commences, the pigment is used in the ovary, with the result that the colour gradually vanishes from the rest of the body, possibly through oxidation.

In no available literature on poultry can any reference be found to this feature in ducks. Nevertheless, there are breeds of ducks which have yellow bills and legs, e.g., the Pekin and White Indian Runner, both of them (and more particularly the former) popular breeds in South Africa. According to the South African Poultry Standards, the bill of the Pekin should be bright orange and free from any black marks or spots. Breeders are very fastidious on this point, and the slightest sign of any discoloration on a Pekin's bill renders the bird unsuitable for breeding purposes.

Unfortunately single pens have not been available for ducks up to the present. If any further work is to be carried out on this breed, it will be necessary to make provision for such pens. The bills and legs of all Pekins were, however, described at the beginning of the laying season in August and subsequently at the beginning of every month. No ducks showing any discoloration in the bill were used in the breeding pens, with the exception of a few cases in which a slight tinge of black was present on the beak.

After a month's production the intensity of pigmentation in the beak diminished, the extent of the decrease varying in different birds. It may be assumed that the pigmentation disappeared sooner in the case of the highest producers. Gradually the yellow coloration was superseded by spots which may be described as freckles. These spots are brown at first and ultimately turn a deep greenish black. The colour of the bill is completely changed and so numerous are the spots on some ducks that from a distance the bill appears quite coloured. Drakes, on the other hand, retained the deep yellow colour of the bill and at the end of the laying period this feature alone made it easy to distinguish them. As the birds went out of production, the yellow colour returned.

From the foregoing it is clear that pigmentation may also be used in estimating the number of eggs laid by ducks. In addition, it should be noted that ducks cannot be judged according to the standard description, since the colour of their bills will depend upon whether the bird is in production or not. When single pens or trap nests are available for ducks, this feature should receive attention.

Some Hints on Onion Planting:—

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The soil should not be allowed to become parched after the transplants start growing. Regular irrigation should be practised throughout the growing period, but restricted during the later stages of development to enable the bulbs to ripen normally.

Among the best late varieties to plant with regard to crop results and keeping qualities, are the Australian Brown and Brown Spanish.

Poisoning of Animals by Algae on Dams and Pans:—

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course, that the pest should be eradicated. Fortunately, algae are very sensitive to copper sulphate and even 1 lb. dissolved in four to five hundred thousand gallons of water is sufficient to destroy the pest. The Government has decided to try and destroy the algae in the Vaaldam, and attempts are now being made to do so.

Sometimes other species of algae are also very troublesome in dams, especially cement dams, but most species can easily be destroyed by dissolving 1 lb. of copper sulphate in every hundred thousand gallons of water. This quantity of copper sulphate in water is insufficient to harm human beings, animals or ordinary plants. If the dam is severely infested, ten to twenty times the above quantity of copper sulphate may be used. The water should be left in the dam for two or three days, and then drained off. Such water must not be used for drinking purposes. If there are fish in an infested dam, not more than 1 lb. of copper sulphate should be used for every three hundred thousand gallons of water, otherwise the fish will be killed. It should be pointed out, however, that it is not advisable to keep fish in small dams used for stock-watering purposes since they only pollute the water.

The best method of dissolving copper sulphate in small dams is first to dissolve the required quantity in one or more buckets of water and then to spray the solution over the surface of the dam with a strong spray pump.

The species of poisonous alga growing in the Vaaldam requires organic material for luxuriant growth. Since this organic material is provided by trees and shrubs decaying under the water, it is recommended that all such growth should be removed before dams, and especially large irrigation schemes, are constructed.

In conclusion, it must be pointed out that, according to information collected, the Vaaldam alga has probably caused stock losses in the past and that the phenomenon is not so new as many people imagine. The Vaaldam has merely provided excellent conditions for the growth of the alga.

Since the Department wishes to discover to what extent this poisonous alga has spread, it will be appreciated if farmers send water suspected of being infested to the Director of Veterinary Services, Onderstepoort. A few ounces of water, sent in about 10 per cent. alcohol and 5 per cent. formalin, or even in methylated spirits, will be sufficient.

Pan sickness, as it is known to farmers, may be caused by the poisonous alga, worm infestation and poisoning by poisonous plants growing around the edge of, or in pans.

Draw up your own Farm Inventory:—

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have crept into his capital investment to be rectified, in order to improve his net results. The farmer must pay attention to all the constituents of his farming enterprise because the success of each is vital to the success of the whole. Neglect is inevitably followed by deterioration and retrogression. During times when maximum production is essential, the danger exists that the production capacity of the undertaking will decline. The farmer can safeguard his future stability, however, by taking wise advantage of prevailing conditions. Circumstances may improve still further and no farmer with a neglected and exhausted inventory can take full advantage of any windfall which he may come in for.

Internal Parasites of Horses.

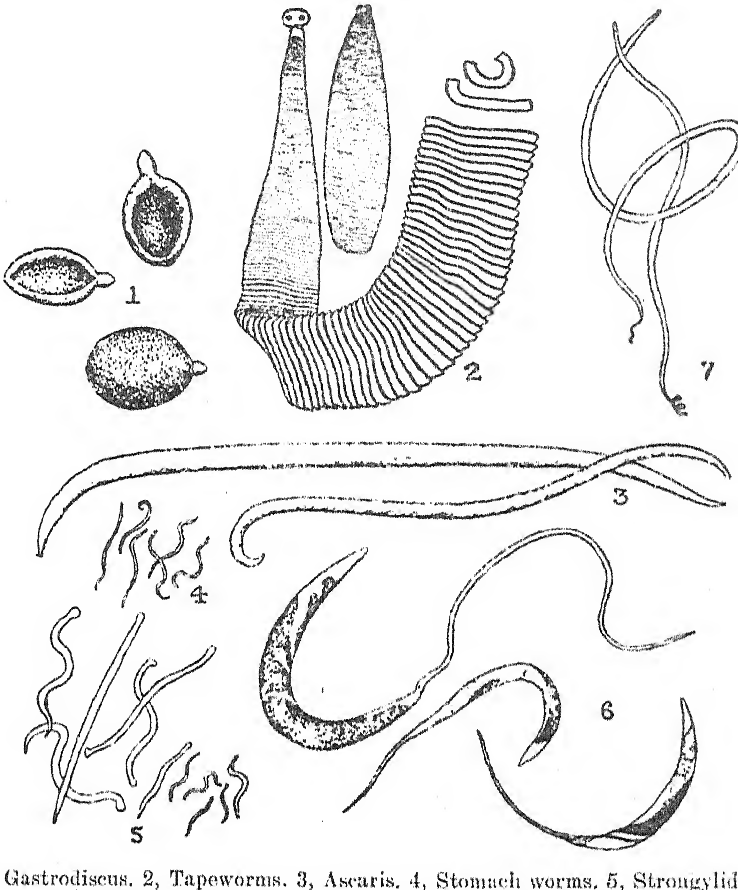
Dr. H. O. Mönnig, Research Officer, Onderstepoort.

THE climatic conditions of the Union are very favourable for the existence and spread of all sorts of internal and external parasites and although parasites do not always kill our domestic animals, they are often the cause of poor condition, weakness and greater susceptibility to other diseases, which result in heavy losses.

Types of Parasites.

The following are the most common internal parasites of horses, mules and donkeys:—

In the stomach: stomach worms (*Habronema*) (Fig. 4) and bots (*Gastrophilus*) (Fig. 8). In the small intestine: tapeworms (*Anoplo-*



1, Gastrodiscus. 2, Tapeworms. 3, Ascaris. 4, Stomach worms. 5, Strongylidae. 6, Pinworms. 7, Setaria. (Ascaris half life-size; others life-size.)

cephala) (Fig. 2); large round worms (*Ascaris*) (Fig. 3). In the colon: tapeworms (*Anophlocephala*) (Fig. 2); small round worms (*Strongylidae*) (Fig. 5); pinworms (*Oxyuris*) (Fig. 6); flukes (*Gastrodiscus*) (Fig. 1). In the abdominal cavity: a round worm (*Setaria*) (Fig. 7).

Flukes.

The fluke (*Gastrodiscus*) (Fig. 1) is a red worm with a round flat body of which the sides are turned up in the form of a saucer, and in front of which there is a short head with a neck. The parasite exists in the colon of the horse, and its eggs appear in the ejected manure. As in the case of other flukes, the young worms, which hatch from the eggs, migrate into a watersnail where they complete a part of their development and multiply on a large scale. The small worms then leave the snail and stick to grass, being ingested by the horse when the latter eats the grass. The parasite is therefore found only in wet places, and is seldom seen in the Union.

Treatment.—This worm is not particularly harmful. If treatment is necessary, then carbon tetrachloride as administered for *Strongylidae* (Fig. 5) will probably be the best.

In order to prevent infestation, the horses should be kept from vleis and other wet places, while the watersnail can be exterminated by means of sulphate of copper as in the control of liver-fluke of sheep.

Tapeworms.

In the Union three types of horse tapeworms (*Anoplocephala*) (Fig. 2) are known. They are white or light-yellow, flat, broad worms from 3 inches to 2 feet in length, consisting of a head and a body divided into a great number of joints. The joints are short and the hindmost ones break off from the worm and are ejected with the manure, appearing as small white or light-yellow worms of about half an inch in length and approximately $\frac{1}{8}$-inch thick, sometimes slightly curled. These joints are full of eggs. The further life cycle is unknown, but it is probable that a small mite acts as carrier. The worms are most prevalent in wet pastures, but are not often seen in the Union.

Through tapeworms, horses can become weak and grow lean.

Treatment.—As yet, no satisfactory treatment has been devised, but the following is usually recommended: Starve the horse for 24 to 36 hours, and then dose it with 2 ounces of turpentine and 1 dram malefern extract in 2 pints of raw linseed oil, for a large horse, given through the mouth by means of a bottle. After four hours the horse is allowed to feed and drink water again.

The Large Round Worm.

The large round worm (*Ascaris*) (Fig. 3) is one of the most common and harmful worms of the horse. It grows from 12 to 20 inches in length, is as thick as a pencil, and white or light-yellow in colour.

Every female lays about a quarter of a million eggs per day which are ejected with the manure of the horse. They must remain outside for 10 days or longer before small worms develop in the eggs which can again infest the horse. The eggs do not hatch and have thick shells, so that they are very tough and can remain alive for a year or longer, while no common disinfectant destroys them. The horse is infested through the eggs which are swallowed with its food and water. The worms hatch out in the intestines of the horse and penetrate into the walls of the intestines until they reach the blood-vessels. They are conveyed with the blood to the lungs where they break through the capillaries and enter the air passages. From there they move up the throat and are again swallowed. They now reach the intestines again where they develop further.

In cases of severe infestation, the young worms may affect the lungs of the horse and have a weakening effect on the former, but the greatest harm is done by the mature worms, which apparently secrete a toxin that tends to weaken the condition of the horse.

Treatment.—Carbon bisulphide is the best remedy. It is given after the horse has been starved overnight. The dose is $2\frac{1}{2}$ cub. cm. for every 100 lb. live weight (15 cub. cm. or $\frac{1}{2}$ oz. for a horse weighing 600 lb.). Since the remedy is volatile and may easily cause the animal to choke, it is usually given through a stomach tube. If the assistance of a verterinary surgeon is not available for this purpose, the remedy may be mixed in half a bottle (not more) of raw linseed oil and carefully administered through the mouth. Two hours after treatment the horse may again be given water and feed. The worms are usually ejected during one week. The treatment must be repeated after 4 weeks. Pregnant mares should not be treated. The eggs of this worm being very tough, it is difficult to eradicate the parasite. Care should be taken that the stable, fodder and water are clean. Young horses especially should be kept in a separate paddock where the ground is as dry as possible and the grass short, so that the eggs can be desroyed by sunlight and drought.

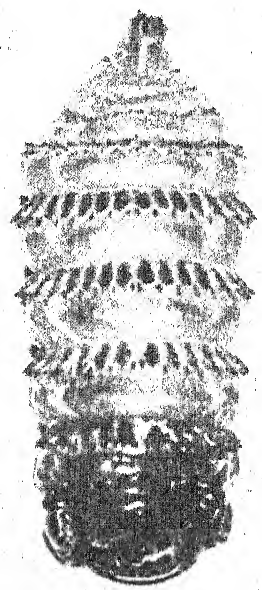


Fig. 8.—A bot.

Stomach Worms.

Stomach worms (*Habronema*) (Fig. 4) are small thin worms $\frac{1}{3}$ to 1 inch in length, which live in the stomach. One type causes stomach growths as large as an orange; the other exists freely in the stomach, sometimes causing a chronic gastritis. Horses which are badly infested may become lean and weak.

The worms lay eggs which hatch in a short while, and the larvae are then ejected with the manure. If the larvae are swallowed by the maggots of flies which breed in horse manure, they develop further and the fly again carries the worm to the horse by dropping into the food or water and then being swallowed by the horse. The fly is an essential carrier of this worm. The small worms are carried by the fly in its mouth, and if the fly settles on the lips or mouth of a horse, the former may come out and in this way enter the mouth of the horse or a wound. Wounds infested in this way will not heal, but remain open for months, while much " wild flesh " grows on the wound.

Treatment.—As in the case of *Ascaris* (Fig. 3) mentioned above, carbon bisulphide is the best remedy for the treatment of stomach worms. Before the remedy is given, it is desirable to wash out the stomach of the horse by means of a stomach tube, using a solution of 2 gallons of water and a half pound (8 ounces) of bicarbonate of soda.

As a preventive, the flies should be controlled, which is best done by treating the horse manure in such a way that flies cannot

hatch therein and that at the same time all eggs and larvae of worms are destroyed. The following method of treating the manure is recommended:—

Baber's Fly-trap.—On a concrete surface four traps are made with iron standards and wire netting. Each trap should be of the required size to hold the manure excreted during one week. Around each trap a small furrow is made so that the edges overhang towards the inside. The manure is firmly packed in and protected against too much rain and if very dry, water is added. The heat of the manure destroys the fly maggots and eggs of the worms or larvae inside the heap, while the maggots on the sides will creep out and fall into the furrow. The overhanging edges of the furrow prevent them from creeping out again. Water or any suitable disinfectant may be poured into the furrow. After the manure has been left for three weeks, it may be removed to the lands, and unless it lies in a heap, flies will not breed in it again.

Small Round Worms.

Small round worms (*Strongylidae*) (Fig. 5) are of different varieties; some are of the size of a match and others much smaller. Some of them suck blood, others do not. They live in the colon of the horse, mule or donkey. The bloodsucking varieties are particularly harmful and cause the animal to become anaemic, weak and thin. In cases of severe infestation, watery swellings may develop on the chest, abdomen and the legs.

The worms lay eggs which are ejected with the manure, and hatch out in the veld when it is sufficiently warm and wet. After a week, the small worms climb into the grass and other plants, and are swallowed by the horse. In the morning and afternoon, especially when there is dew present on the grass and the sunlight is not very strong, the small worms climb up against the grass, otherwise they take cover near to or in the ground. Summer is the most favourable season and horses which graze in vleis and other wet places are particularly liable to become heavily infested.

Treatment.—Carbon tetrachloride is the best remedy. If the horse can endure it, it should be starved for 36 hours. The remedy is volatile and should be given through a stomach tube, which reaches well into the stomach of the horse. The dose is 5 cub. cm. per 100 lb. live weight (30 cub. cm. or one ounce for a horse weighing 600 lb.). Well-bred horses should be given half this amount and foals of such horses still less, e.g., 4·5 cub. cm. for a foal weighing 250 lb. Pregnant mares may be treated, but preferably not during the last 2 to 3 months. After the remedy has been given, the horse should be kept without food and water for 4 hours.

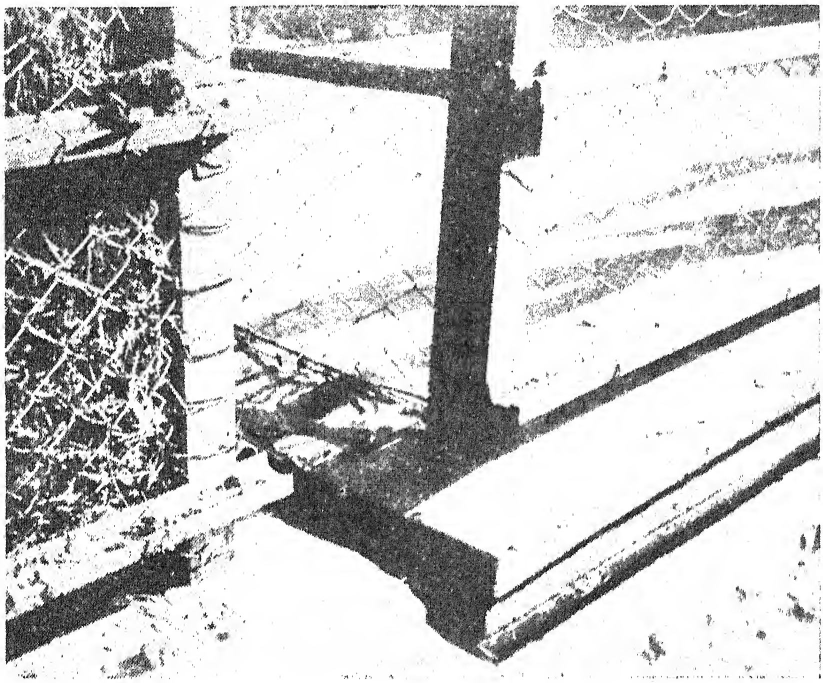
Phenothiazine is a new and very effective remedy against these worms. It is a powder which can be mixed with moistened bran, and is usually taken readily by horses. The dose is 25 to 30 gm. per 1,000 lb. live weight. After treatment the horse's urine becomes red and it is advisable to rest him a few days. Weak, and especially anaemic horses, should not be treated. The remedy sometimes has a harmful effect and should be administered only under the supervision of a veterinarian.

In order to avoid infestation, horses should, as far as possible, be kept away from wet pasture and they should receive clean food and water. They may also become infested in the stable; the bedding should therefore be renewed often and the stable kept as dry as possible, and sufficient light should be provided. The eggs of the

worms hatch in a damp stable and the larvae live in moist bedding. The habit of leaving the bedding underneath the manger during the day aids the larvae, especially if the stable is also kept dark, to climb up into the manger, where they get into the feed of the horse.

Pinworms.

Pinworms (*Oxyuris*) (Fig. 6) are often present in horses. The males and young females live in the front portion of the colon, while the mature females are found in the back portion of the colon. These full-grown females are blue-grey in colour, and sometimes have brown spots. The body is short and thick, approximately ¾-inch in length, and has a thin tail which may be 2 to 3 inches long. The female creeps out of the horse's anus with the front part of her body and lays her eggs on the skin under the horse's tail, while she



Baber's fly-trap.

holds on to the inside of the intestine with her tail. The worms can often be seen when the horse passes manure and they may also pass out with the manure. The eggs can be seen as pale yellow, froth-like masses on the skin underneath the tail. The eggs remain here for about three days; then they drop off and may again infest the horse when they are consumed with its food and water.

The pinworm is more troublesome than harmful. The females, which lay eggs, set up an irritation, which causes the horse to rub its tail against any suitable object. The hair on the root of the tail is always disarranged and partly broken off.

Treatment is difficult and consists of administering an enema and giving a remedy. The enema is intended to kill the full-grown females and it is best to administer it 2 to 3 days after the other

remedy has been given, or to repeat it. The horse is starved for 36 hours and is then given Chenopodium oil, 18 cub. cm. in 2 pints of raw linseed oil per 1,000 lb. live weight. Food and water may be given four hours afterwards. One to two gallons of luke-warm water, in which are dissolved 4 ounces bicarbonate of soda per gallon may be used as an enema. At the same time it may be necessary to wipe off daily with an oil rag any eggs which may be under the tail, and to provide clean bedding, feed and water. Even if the eggs alone are wiped off and the stable and food are kept clean, the trouble will disappear, because the worms do not live in the horse for a long time.

Round Worms in the Abdominal Cavity.

The round worm in the abdominal cavity (*Setaria*) (Fig. 7) is a milk-white worm, about 3 inches long, which exists in the abdominal cavity between the guts. The worm creeps about and may also be found in the scrotum. It is altogether harmless. Similar worms are often found in buck and also appear in cattle.

Bots in Horses.

Bots (*Gastrophilus*) (Fig. 8) are the maggots of the bot-fly and are found in the horse's stomach or throat where they stick. There are different kinds of bot-flies which lay their eggs on the hair of the horse, especially on the fore-legs and fore-quarters. They are the small light-yellow nits which are so generally known. Other types lay their eggs on the hair surrounding the horse's mouth, as well as on the manger or other objects.

After a week or 10 days, the eggs are ready for hatching, and if the horse should lick the nits, the small maggots will creep out and in this way enter the mouth of the horse. The eggs which are laid near the mouth usually hatch spontaneously, and the maggots creep into the mouth. The young maggots then penetrate the mucous membrane of the mouth cavity and creep slowly towards the throat. They are located fairly near the surface and are not really harmful in that position. It takes about four weeks before they reach the back of the throat where they become detached and are swallowed. One variety may remain in the throat for a longer period and may develop to a fair size; it is blood-red in colour.

In the stomach, the maggot or bot hooks on with two small hooks situated in front of its head. It develops slowly, reaching the full-grown stage after about 10 months. It then releases its grip and passes with the manure through the intestines. A few bots again remain in the hind portion of the intestine (rectum), where they stick before passing out. The maggot then creeps into the ground, where its skin becomes hard and dark; and after a month, a fly appears.

Treatment.—The flies are most active in summer, so that bots are in the horses during the winetr and appear as full grown parasites after winter. The best time to treat horses against bots is at the beginning of winter, after all the flies have disappeared.

Bots are often regarded as very harmful, but that is not really the case. Heavy infestations may interfere with the digestion and action of the stomach, and the animal may become thin, while the full-grown maggots, which pass out, may irritate the intestine. It very seldom happens that the bot perforates the stomach wall, causing the horse to die of peritonitis.

Carbon bisulphide is the best remedy for curative treatment (see under *Ascaris*). Carbon tetrachloride, as given for *Strongylidae*, also

[Continued on page 521.

Groundnuts for Chicken Rations.

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IN the search for substitute ingredients to supplement the protein deficiency in poultry rations arising from the shortage of meat meal and fish meal, the excellent results obtained with ordinary bean meal, have led to tests being carried out with groundnut meal as well. Of all the sources of plant proteins, groundnuts appear to be one of the most practical and economical substitute ingredients for partially supplementing the present protein shortage in this country.

The principal reason why groundnuts are particularly suited to this purpose is that large quantities can be grown locally. In addition the production of the crop is encouraged by the Department. Consequently, we need not be entirely dependent on external sources which may not always be readily available. Moreover, the seed contains a considerable quantity of oil for which there is a great demand and which can be easily extracted by existing factories. The residual product known as oil cake meal, is a valuable source of protein.

Hitherto local factories have imported the greater part of their requirements, but in view of the increased local production, it can be expected that large quantities of undergrade nuts will be placed on the market. By undergrade nuts is meant that part of the crop which consists of shrunken, broken or otherwise damaged nuts. Such nuts are unsuitable for human consumption and, in addition, their oil content is usually too low for this purpose. Whereas nuts of the highest grades contain 51 per cent. oil, the oil content of shrunken nuts is barely 40 per cent. Shrunken nuts contain a much higher percentage of free fatty acid, because the oil-forming process has not yet been completed. This is another undesirable factor in oil production, since the acids in the extracted oil have to be neutralized by processes which involve the factory in considerable additional expense. Oil containing large quantities of acid can be used only for manufacturing inferior products. The most logical use to which such products can therefore be put is to supplement the protein portion of livestock rations.

Nutritional Requirements.

Groundnut meal is fairly rich in lysine (one of the animo-acids which is absolutely essential for growth). Generally speaking, the mutual supplementary value of plant proteins is very small. According to nitrogen metabolism studies carried out with rats, cottonseed meal, for example, has a higher bilogical value than groundnut meal; when the former was fed in conjunction with maize, however, it showed practically no supplementary value. Groundnuts on the other hand definitely supplemented the protein of maize and a combination of these two crops ensured better growth than maize alone.

The oil contained in groundnuts has a high value and is readily digestible. Groundnut protein, like all other plant proteins, must be supplemented with minerals. Groundnuts are a good source of phosphorus, but although the crop also contains calcium, the quantity present is inadequate for normal growth and must therefore be supplemented.

Raw groundnuts contain a large quantity of vitamins. They are particularly rich in thiamin (vitamin B) and riboflavin (B_2), both

of which play important rôles. The coloured testa or skin covering the groundnut seed is the richest known source of thiamin. In normal times there was no danger of a shortage of thiamin in poultry rations, since this vitamin was supplied by the germ and bran of cereals. Now, however, we have lost an important source of this vitamin, namely, the wheaten products bran and pollard. A deficiency of riboflavin results in slow growth, low hatchability and nutritional leg paralysis (knuckle walking). Brewers yeast, the richest source of riboflavin, is unobtainable to-day. Milk in one form or another is not always available. Green feed and lucerne meal do not provide the total requirements in this respect. Consequently, any nutrient which adds riboflavin to our poultry rations, no matter how small the amount may be, definitely deserves recommendation

It is also highly probable that groundnuts are a good source of the other members of the vitamin B group as, for example, pyridoxin (vitamin B) and pantonine acid, since the B vitamins usually occur together in plant material. As far as is known, special attention need not be given to pyridoxin (vitamin B_6) as a constituent of poultry rations, but pantonine acid is important since it accelerates growth in chicks and also prevents the formation of sores in the corners of their beaks and the well-known sealing of the eyes.

Undergrade Groundnuts.

Groundnut oil cake meal, which is the residual product after the oil has been expressed from groundnuts, is better known among dairy farmers than among poultry farmers in this country. Although certain poultry farmers are using small quantities of this product, they are few and far between. There are several possible reasons why the product has not been more widely used, the most important being that is it not commonly known and that the digestive tract of a bird is said to be ill-adapted to handling large quantities of fat. Groundnuts have always been regarded as fat bearing without the chemical composition of the oil ever having been taken into consideration.

Since groundnut oil cake had already received some attention in feeding experiments, and as reasonable quantities of groundnuts which were described as shrunken were offered for sale, it was decided to test these seeds as an ingredient of chicken rations. The main object of these experiments was to determine the extent to which undergrade groundnuts meal could be used as a substitute for animal protein, such as fish meal, in practical chicken rations.

The groundnuts used for this purpose consisted mainly of shrunken seeds mixed with small quantities of pods, stalks, etc., which contained 38·2 per cent. protein and 3·5 per cent. fibre. Milling presented no difficulties, although the product obtained was somewhat coarse, since the meal in a roller mill is inclined to compact owing to the high oil content of the nuts. For milling purpos the ordinary hammer-mill appears ideal.

Rations.

The experiment was commenced on 17 June 1942, with 250 W Leghorn chicks divided into 5 groups of 50 each. From the first until the chicks were four weeks old, they were kept in an electr battery brooder, in which each compartment for the various groups was separately heated. During this period cod-liver oil was fed as reflected in Table I. After the fourth week the chicks were moved to chicken houses, measuring 10 feet by 12 fe , each being provided with a cement run. In these houses no provis was

made for artificial warmth. Green feed, consisting of finely cut oats, was given twice a day. The rations fed are given in Table I.

TABLE I.—*Rations fed from 1st day to 10th week.*

Ingredients.	Groups.				
	1	2	3	4	5
Yellow mealie meal..........	55	59½	50	49	44½
Wheaten bran...............	16	—	—	—	—
Oatmeal....................	10	10	10	10	10
Lucernemeal................	7	10	10	10	10
Groundnut meal.............	—	10	20	25	30
Fish meal (concentra)........	18	16½	13	10½	9½
Oystershell powder...........	1½	1¼	1½	1	1½
Bonemeal...................	—	¼	1½	2	2
Fine salt....................	½	½	½	½	½
Cod-liver oil.................	1	1	1	1	1
Manganese Sulphate, $MnSO_4$..	1 oz.	1 oz.	1 oz.	1 oz.	1 oz.

TABLE II.—*Analysis of Rations.*

Ingredients.	Groups.				
	1	2	3	4	5
Crude protein...............	19·6	19·8	19·9	19·8	19·9
Calcium....................	1·5	1·5	1·5	1·5	1·5
Phosphorus.................	0·9	0·8	0·8	0·8	0·8
Crude fibre..................	4·7	4·5	4·7	4·8	4·9

TABLE III.—*Average weight and feed consumption per chick at the ages of 4, 8 and 10 weeks, respectively.*

Groups.	4th Week.			8th Week.			10th Week.		
	Cockerels.	Pullets.	Consumption.	Cockerels.	Pullets.	Consumption.	Cockerels.	Pullets.	Consumption.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	0·36	0·33	0·90	1·17	1·09	3·32	1·68	1·50	5·20
2	0·42	0·39	0·87	1·28	1·14	3·54	1·94	1·60	5·50
3	0·43	0·39	0·90	1·20	1·13	3·14	1·90	1·58	5·07
4	0·40	0·37	0·98	1·23	1·10	3·55	1·77	1·49	5·20
5	0·40	0·37	0·87	1·20	1·14	3·17	1·72	1·54	5·03

Table III reflects the average weight and feed consumption per chick at the ages of 4, 8 and 10 weeks. These weights must be regarded as very satisfactory. Although the weights are somewhat lower than those attained with ordinary bean meal, the feed consumption was also relatively lower, which must be ascribed to the fact that more green feed was given to these groups from the start. A noteworthy fact is that Groups 1 and 4 consumed exactly the same quantity of feed. In the latter group, 22·9 per cent. of the ration consisted of groundnuts, which clearly show that the addition of this product did not affect the palatability of these rations and that even

the high percentage of oil contained in the groundnut had no aparent ill-effect on the digestion.

No cases of toe pecking or cannibalism occurred in any of the groups. Feather eating, however, occurred in all groups, but not to the same extent. From the third week it was noticed that the chicks pecked one another on the keel, back and along the tail. At the end of the fourth week, when the chicks were transferred to the chicken houses, a note was made of the number denuded of feathers on the parts mentioned above. This trouble gradually diminished, with the result that at the age of 10 weeks all the chicks were well covered with feathers. The numbers which revealed a tendency towards feather eating are given in Table IV.

TABLE IV.—*Number of feather eaters at ages of 4 and 10 weeks, respectively.*

Group.	FOUR WEEKS OLD.			TEN WEEKS OLD.		
	No. at 4 Weeks.	No. of Feather Eaters.	Per cent. Eaters.	No. at 10 Weeks.	No. of Feather Eaters.	Per cent. Eaters.
1................	49	3	6·12	49	—	0
2................	46	2	4·34	46	—	0
3................	49	1	2·04	49	—	0
4................	47	4	8·51	47	—	0
5................	47	10	21·48	47		0

Among the chicks kept on ration No. 1, which served as a control ration in previous feeding groups, no cases of feather eating occurred.

As will be observed, such cases did occur on this ration, but as the tendency had entirely disappeared by the tenth week when the last four groups had an exceptionally glossy feather cover, the cause of the trouble appears to lie elsewhere. The only possible cause may be the heating which was interrupted at intervals during the second week as a result of failures in the main electric power supply. The chicks of group 5, which had the largest number of feather-eaters, would have been most seriously affected by these failures, since they were nearest to the cold cement floor. This, together with the cold weather which was experienced during this period, must undoubtedly have had an effect on the chicks which, on the whole, were used to a uniform temperature. A last possible cause may be the fact that wheaten bran was excluded from the last four rations. Experience gained at this Institution since the disappearance of bran and pollard from the market shows that these two products contain properties which prevent feather eating in poultry.

All chicks which died during the first five days were replaced by chicks which had been kept in reserve for this purpose, since it was assumed that death at this early age could not have been due to the ration. During the fourth week knuckle walking occurred, this condition being due to deficiency of riboflavin. After the chicks had reached the age of four weeks and it was consequently assumed that all perceptible signs of flavin deficiency had already become manifest, skimmed milk was fed for two days to all groups. All affected chicks recovered and no further cases occurred.

TABLE VI.—*Health and mortality until the age of 10 weeks.*

	Original Number of Chicks.	FLAVIN DEFICIENCY.		PERCENTAGE MORTALITY.			
		Knuckle Walking.	Percentage Knuckle Walking.	4th Week.	8th Week.	10th Week.	Total Mortality.
							Per cent.
Group 1.......	50	3	6	2	2	2	2
Group 2.......	50	3	6	8	8	8	8
Group 3.......	50	5	10	2	2	2	2
Group 4.......	50	3	6	6	6	6	6
Group 5.......	50	1	2	6	6	6	6

Conclusions.

The following conclusions were arrived at from the foregoing data:—

1. Undergrade groundnuts, described as shrunken nuts, may constitute as much as 27·5 per cent. of the total ration, and on a lb. basis, 3·5 lb. groundnuts may be successfully used to replace 1 lb. fish meal with a protein content of 65·5 per cent.

2. All the rations under discussion revealed a deficiency of riboflavin as is proved by the cases of knuckle walking which occurred even where green feed was given twice a day. During the first three weeks chicks apparently eat too little green feed to supply the necessary flavin. On the protein basis of these rations this deficiency must be supplemented with brewer's yeast or skimmed milk.

3. In view of the present protein shortage, it is economical to feed animal and vegetable proteins together in rations. In this way the plant proteins can supplement the animal proteins and a combination of proteins invariably gives better results.

Internal Parasites of Horses:—

[*Continued from page* 516.

destroys bots fairly effectively. The treatment should be repeated after one month, since the young maggots, which are in the mucous membrane of the mouth, are not killed by the first treatment.

As the nits require about a week to develop before they hatch, it may help considerably if the spots where the eggs are located on the horse are rubbed weekly with a rag moistened in a 2 per cent. solution of carbolic dip, since this treatment will destroy the eggs. In addition, the stable, and particularly the manger, should be kept clean in order to ensure the regular removal of the eggs which may be there.

A Loose Dutch Oven.

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MODERN ovens are built more elaborately than the loose Dutch oven here described. The modern oven is generally lined with firebrick and is provided with a separate flue about 9 in. square, with a damper and also with an ash drop of standard cast-iron unit type leading either to the side of the fireplace or to an ashpit in the chimney base.

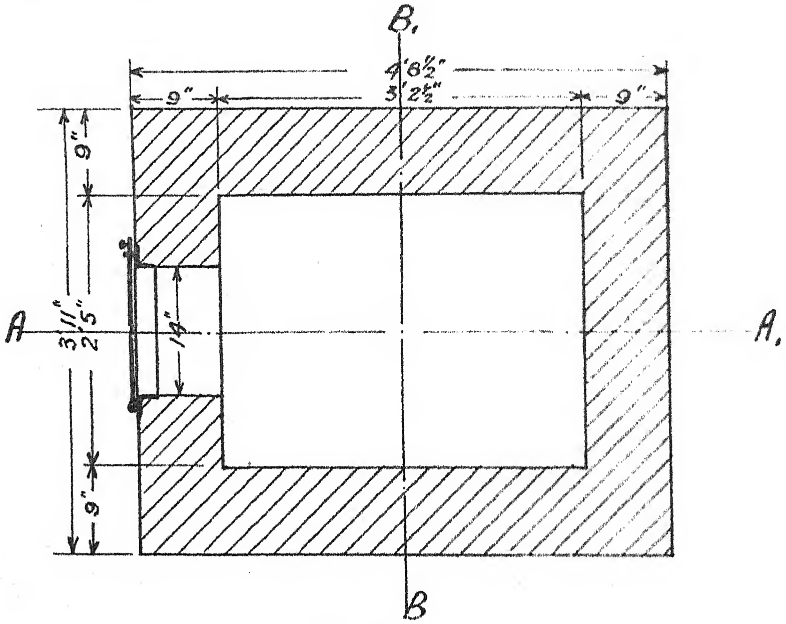

FIG. 1.—Plan.

Owing to the scarcity of material and the difficulty in obtaining available supplies a very simple, yet effective type of Dutch oven, which can be built on any farm yard with scrap material and third class bricks is described here.

This type of oven is often built in connection with both indoor and outdoor fireplaces to copy early kitchen fireplaces or for actual baking. When used as an ornament, the oven is fitted with a cast-iron door and the space thus formed may be used for wood storage. Spaces used for wood storage should be separated from the fireplace by a brick or stone partition at least 8 inches thick. All joints being completely filled with mortar.

It is advisable to line the oven with firebrick and the masonry should be at least 9 inches thick. A greater heat-storing capacity is secured by using thick walls.

Specifications.

The question of size to build the oven is arbitrary.

Factors to be considered on deciding upon a size are, number of loaves to be baked, size of pans, convenience of handling, and the bond, so that unnecessary cutting of brick is eliminated.

For an oven of the size according to the accompanying drawings, 520 bricks are required for the foundation or base and floor, and 330 for the oven proper.

The dome (*a*) should be carefully formed with brick moulded or ground to an arch. Alternatively, the top of the oven may be flat, but then several lintel irons will be needed to support the brick. In order to build the alternative shape (Fig. 6) the hollow space (*b*) may be filled with damp sand to the desired shape to act as a mould.

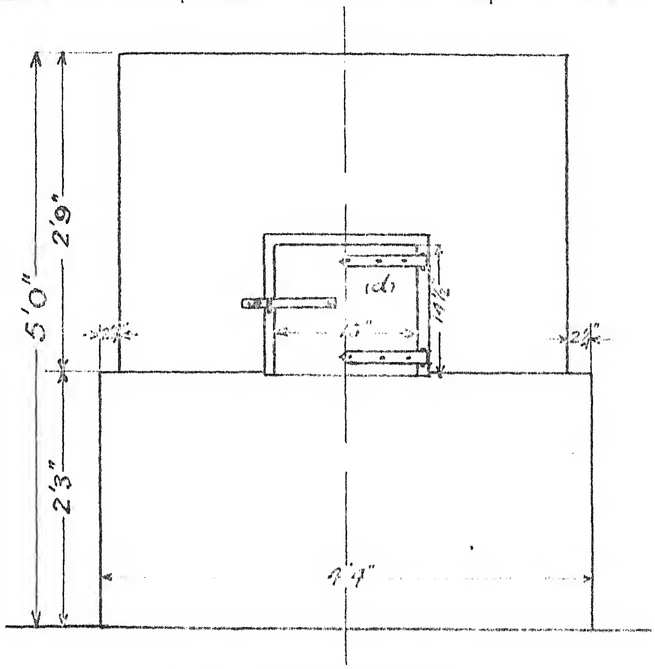

FIG. 2.—Front Elevation.

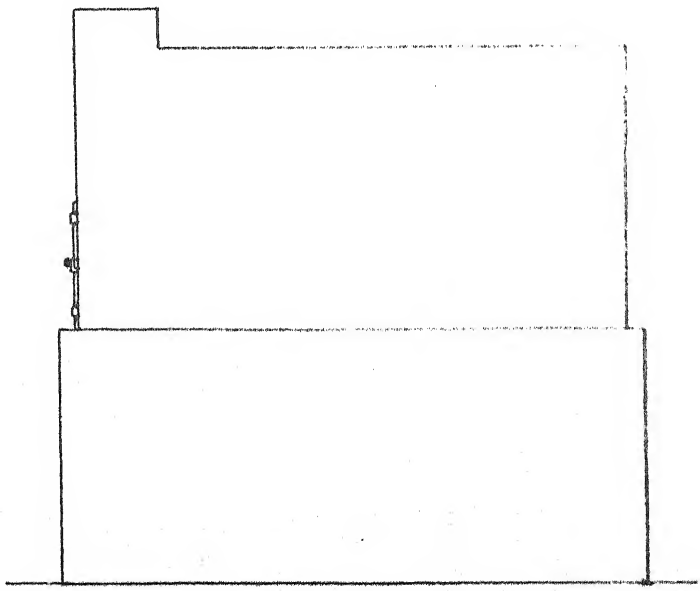

FIG. 3.—Side Elevation.

When the brickwork is complete the sand is scraped out. The alternative shape is sometimes preferred by housewives, though it does not appear to have any decided advantage over the other shapes. While building, an opening (c) the size of a brick should be left as shown. This opening serves as a smoke outlet while firing the oven and should be closed with a brick and mortar while the bread is baking to prevent the heat escaping.

The door opening should preferably be fitted with a cast-iron door (d) of the ordinary kitchen range type. The door from an old

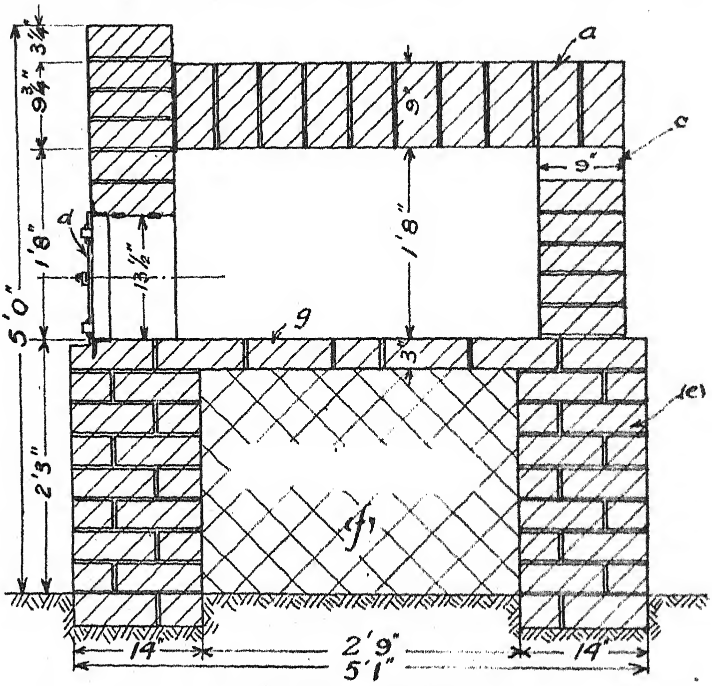

FIG. 4.—Section A A.

discarded kitchen range is very satisfactory. Alternatively, a door may be easily made by the local blacksmith or by the farmer himself. Angle iron of 1¾ in. may be used for the frame and sheet metal about 3/16 in. thick or more will be quite suitable for the door. Hinges may be rivetted on as shown in Fig. 2. Very often these ovens are not fitted with a door at all, the opening merely being shut by a strip of sheet iron and the edges plastered up temporarily with mortar.

The foundation (e) may be of brick, as shown (Fig. 4) or of flat stones, etc. The height is arbitrary, but for the sake of convenience it should be raised.

The space (f) within the foundation should be filled with rubble and firmly stamped down. The floor (g) may be a single course of brick built in mortar.

All brickwork should be laid in mortar consisting of sandy loam mixed with a little cowdung.

The oven should be plastered externally with a plaster consisting of a mixture of one part cowdung to two parts sandy loam. The joints between the bricks should be raked out to a depth of about ¾ inch, but the brickwork should not be wetted before applying the

plaster. Apply the plaster to a thickness of not more than ¼ inch, pressing it well into the raked-out joints, and, leaving a rough surface. This first coat should be left until it has become quite dry

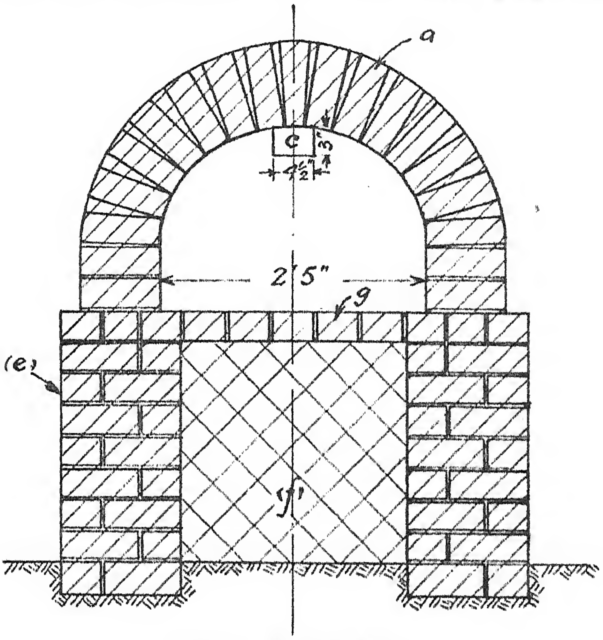

Fig. 5.—Section B B.

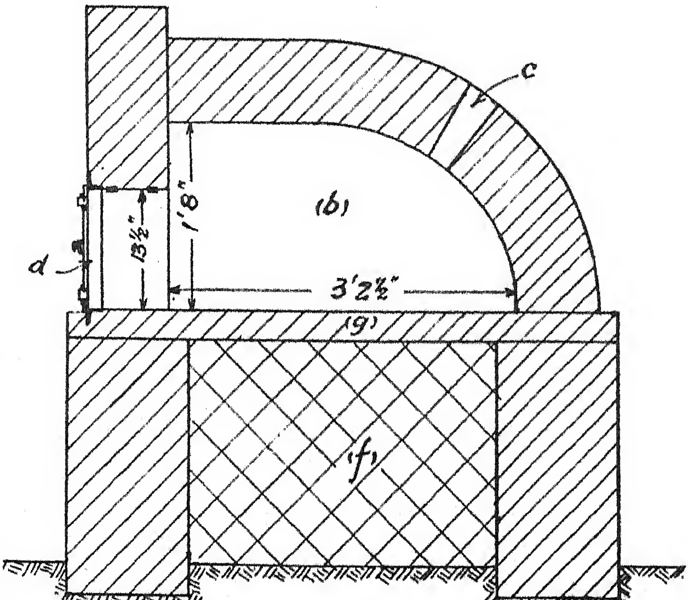

Fig. 6.—Alternative Longitudinal Section.

and hard. A second coat, of a similar composition to the first, except that it contains a slightly greater proportion of sandy loam to make it harder when dry, is then applied to a thickness of about ⅜ inch,

 [Continued on page 529

Poultry Hygiene.

Dr. O. T. de Villiers, Senior Professional Officer (Veterinary Science), Stellenbosch-Elsenburg College of Agriculture.

PREVENTABLE poultry diseases are responsible for heavy losses in the western Cape Province where poultry farming has assumed great importance, and the object of this article is to familiarize beginners with the main principles of poultry hygiene and sanitation.

Poultry Site.

It is very essential that poultry quarters should be on well-drained soil or be located on a gentle slope for good drainage. Artificial drainage must be resorted to if the soil renders natural drainage impossible, for stagnant water favours the development of harmful germs and parasites. The causal organisms of diseases, like fowl typhoid, tuberculosis and coccidiosis, may survive for long periods in moist soil and excrement. The run should have a free exposure to sunlight, particularly in winter, but shade must be available in hot weather. Trees with smooth bark, such as fig, mulberry, plum and peach trees are very suitable for this purpose. They provide cool shade but no hiding places for the fowl tick and other dangerous parasites.

In the semi-intensive system of poultry farming alternate runs should be provided so that the soil in the one run may be rested while the other is in use. Keeping birds on the same ground, year after year, causes the soil to become a hotbed of infection if parasitized or diseased birds are present in the flock. Overcrowding should also be avoided. Grow a green crop on the ground from which the birds have been removed, or spread quicklime over the ground every month, dig over the soil and leave the run idle for at least six months. Very fine sand, to which a little sulphur, tobacco dust or coal ash has been aded, should be placed at the disposal of the fowls so that they may bathe in it.

Housing.

Use iron, bricks, concrete or cement-treated sacking in preference to wood in building a poultry house. (Your College of Agriculture will advise you regarding the construction of a poultry house.) The selection of material will depend on climatic conditions in the particular area. Iron houses are often too hot in summer and too cold in winter.

Crevices in walls should be avoided as they form the favourite hiding places of dangerous parasites, such as the adult fowl tick and the red mite. Wooden poles must be stripped of their bark, cracks filled and the poles painted with a tar paint. A house should be designed so as to give ample light and ensure the entrance of an abundance of direct sunlight. Good lighting inhibits attacks from red mites which suck blood even during the day when fowls sit in dark places, e.g. hens laying or brooding. Dark houses tend to make birds roost early and rise late. They, therefore, eat less and produce less. Sunlight is important to the health of fowls and is destructive to bacteria and parasites. Thorough ventilation is very important, but draughts should be avoided, as they lower the resistance of birds and render them an easy prey to disease. Draughts and wet houses are indirectly responsible for many outbreaks of roup and other respiratory troubles.

The open-shed tipe of house is the best and cheapest, and it should face north-east, so that the morning sun can have access to

the interior and the birds will be sheltered from the south-east wind and the north-west wind and rain, which prevail in the western Cape Province.

The ground should slope from the front of the house. The floor must be watertight and hard, and slope to the front, where drainage holes are provided. Regular cleaning and disinfecting of the house is essential. This procedure will be much faciliated if everything inside the house is movable.

Each bird should have approximately four square feet of floor space and about eight inches perch space; the roosting perches must not be near the exposed front of the house.

Rations and Drinking Water.

A well balanced ration is of prime importance. Mouldy or decomposed food may prove very injurious, especially to young chicks. Limberneck may result from the eating of decomposed flesh and forms of nutritional disease from lack of suitable green feed.

Provide plenty of clean, cool water. The drinking water soon becomes slimy due to mucous and food particles in the mouths of the birds. Clean water should be given at least twice a day during the summer. Water containers should be so devised that fowls cannot deposit their droppings into the water, and must be kept scrupulously clean. The addition of disinfectants to the water is of little avail, but during an outbreak of disease disinfectants may prevent the disease producing organisms from multiplying.

Introduction of Diseases.

Disease is often introduced by new birds or by birds which have come from poultry shows. Such birds should always be isolated for a month. They may be sickening for some dangerous disease, like fowl typhoid, although they look quite healthy. Birds recovered from serious diseases, like fowl typhoid and bacillary, white diarrhoea sometimes remain carriers and discharge infected excreta.

New stock should be bought from holders of the "Bacillary White Diarrhoea Test Certificate", particulars of which may be obtained from the Director of Veterinary Services, P.O. Onderstepoort. The bacillary white diarrhoea test shows up carriers of both bacillary white diarrhoea and fowl typhoid.

It is desirable that visitors from other poultry plants be provided with clean overshoes before they enter the plant, for infected excrement may be on their shoes. Rubber boots may be disinfected in a two per cent. lysol or other suitable disinfectant.

Outbreak of Disease.

In case of an outbreak of disease, veterinary advice should be obtained as early as possible, for diseases like fowl typhoid and bacillary white diarrhoea may decimate a flock very soon. Poultrymen would save themselves considerable trouble and expense if they would obtain competent advice instead of giving undue heed to the advice of unqualified strangers or even to that of well-meaning but uninformed neighbours. In many places poultry disease diagnosticians are unfortunately not readily available and in such cases a few sick birds should be forwarded as soon as possible to the Director of Veterinary Services, Pretoria North Station (postal address Onderstepoort), and full particulars supplied, viz., symptoms, postmortem appearance (if fowls have been opened), number of deaths and intervals at which they have occurred, previous history of poultry disease on the farm and details regarding any inocculations,

number of adult poultry and chicks kept, food given, composition of mash, housing conditions, amount of floor space in square feet allowed for each bird, incidence of tampans, lice, fleas, worms, etc. Birds must be sent in strong crates containing food and water in receptacles that cannot be overturned and live birds may be forwarded carriage forward. Sick birds are more satisfactory for examination than dead ones, but if only dead birds are available, merely wrap them in hessian and forward them carriage paid. Ten percent formalin solution or some other repellent should, in warm weather, be sprinkled over the carcases to keep off flies. Small chicks can be sent in ordinary well ventilated cardboard boxes. Sick birds should be kept quite apart, and carcases should be buried or burned, while advice regarding the material sent away, is awaited. If only a few sick birds remain it will be best to destroy them and so attempt to prevent the spread of infection. Healthy birds should be removed to a clean house and ground, if possible, and the house thoroughly disinfected in the following manner:—

Disinfection of Poultry House.

Remove everything movable to a place just outside the poultry house and pour on boiling water to which a little caustic soda has been added. Scrub the window frames, sweep the floor well and burn the sweepings.

If the droppings are hard to remove soften them with boiling water containing a little caustic soda. After the house has been cleaned spray the whole of the interior with a suitable disinfectant, such as 5 per cent. crude carbolic acid or a 2 per cent. caustic soda solution. One may also add a little lime to the disinfectant as it will aid in showing up spots that were not sprayed. See to it that the fluid penetrates all cracks. The articles removed from the house must also be sprayed before they are replaced. The ground around the house should be covered with quicklime and dug over. If the healthy birds have to be re-admitted at once, then they should be confined there until there is no further evidence of the disease. During this period of confinement, the healthy birds should be watched carefully and any sick bird must be removed immediately.

If a house is occupied by both sick and healthy birds, it must be thoroughly cleaned daily and the litter burned. If the same person must tend to all the fowls, then the sick ones should be attended to last, in order to prevent mechanical transference of the causative agent of the disease to the healthy birds. The attendant should use rubber boots which have been disinfected before entering and after leaving a pen or house.

A Loose Dutch Oven:—

[Continued from page 525.

and is finished off as smooth as possible. The work may be finished by a coat of whitewash or boiled linseed oil, applied when the plaster has become dry.

The oven is preheated by a wood fire or hot coals, and before food is placed in the oven, the coals and ashes are raked out through the door. The smoke outlet is then closed as stated above.

The loaves of bread are placed on the floor with a wooden paddle, shaped like an ordinary spade, but with a long handle. An iron hook made of ½ in. rod iron is useful to rake out the baked loaves.

A thermometer could be built into the roof but after a little experience the housewife knows when the oven is sufficiently hot to take the food.

Before putting an oven into use it should be thoroughly baked for about half a day to dry it out and remove all odours.

Aimless Breeding of Poultry.

C. R. Liebenberg, Department of Poultry Husbandry, Stellenbosch-Elsenburg College of Agriculture.

THE prevailing high prices for table poultry, eggs, day-old chicks, etc., have resulted in a great expansion of commercial flocks in the western Cape Province. This apparent prosperous expansion is fraught with serious dangers, since quality is being sacrificed for the sake of numbers, and the harmful results of this practice have already manifested themselves in more than one flock during the past breeding season.

The poultry industry is being seriously menaced by aimless breeding, since every egg is regarded as a good egg for breeding purposes and every chicken as a good chicken. Such a policy cannot but endanger the poultry industry. Constitutional weaknesses, cases of paralysis and, consequently, the rate of mortality from the first day up to the age of 5 months are increasing. Furthermore, losses are being suffered because in many cases the sudden expansion has been out of all relation to the available facilities for the rearing and housing of poultry. The next breeding season is almost at hand. Indeed, certain commercial breeders have already commenced with their breeding activities. A word of warning is therefore necessary at this stage for unless culling is carried out more systematically and greater attention given to the quality of breeding stock, the evils of last year will be progressively intensified.

Direction in Breeding Policy.

A properly directed breeding policy is absolutely essential, and strict attention should be given to the following factors:—

(1) *Different blood strains.*—Every year large numbers of breeding hens are mated with roosters without any regard to the parentage or breeding of such birds. Roosters are purchased simply on the strength of their appearance. Such a policy cannot possibly result in any lasting progress being effected. The most that can be said of the progeny of such birds is that they are fowls, since nothing is known of their origin or production capacity. To purchase new roosters every year without due regard to the pedigree of such birds is to court disaster, especially where increased egg production is concerned. Where two or more blood strains are built up in the flock, breeding from such strains can be practised for years without the flock being exposed to the manifold dangers attendant upon the introduction of new blood every year. This is a policy which is practicable even in commercial flocks. More detailed information in regard to the breeding methods which could be applied, are obtainable on request from the above institution.

(2) *Constitutional vigour* is a factor which is affected not only by environment, nutrition, housing, management, etc., but also by the quality of the breeding stock itself. If chickens are to grow out strongly and rapidly, to produce satisfactorily and to be able to offer resistance to artificial and sometimes unfavourable environmental factors, it is absolutely essential that the breeding stock should possess this character in the highest degree. In spite of all that has been done through extension work to instruct breeders how to judge these characteristics in an animal, it is almost appalling to see how little attention is given to this requirement of vigour in breeding pens during the breeding season.

(3) *B.W.D. and fowl paralysis* are two diseases from which many thousands of chicks and young fowls die every year. Many breeders are aware of the presence of these diseases in their flocks, but make no effort to control them, hoping that the position will improve of its own accord the following year. Day-old chicks are also sold from these infected flocks. The facilities for testing and control are offered and undertaken by the Government at a very nominal fee. To spread diseases through the sale of breeding stock, day-old chicks, etc., is a very short-sighted policy which will cause the industry incalculable harm.

(4) *Immature breeding birds.*—It is impossible to expect good results or any measure of success by using immature cockerels and pullets in the breeding pens. Sometimes it is necessary to breed from pullets in order to obtain early chicks, but care must be taken to ensure that such birds are at least fully developed, or if their treatment has been normal, that they are not younger than 9 or 10 months. Such pullets should be mated with two- or three-year old roosters. Undersized and weak chicks are being hatched which not even the very best treatment will ever turn into strong, vigorous producers. Their development is retarded and the rate of mortality abnormally high.

(5) *Standard characters.*—For the sake of the industry and the good name of the producer, greater importance and value should be attached to breed characteristics. Wide divergences in type and structural characteristics are encountered, but in the final analysis all the different parts of the body constitute the whole which should be capable of ensuring maximum production. The various parts of the body should be in proportion, and only birds with strong, normal bodies should be placed in the breeding pens.

Breeders, and especially commercial undertakings, which, in addition to their ordinary activities, also dispatch considerable numbers of day-old chicks to all parts of the country, should pay stricter attention to these few points. If this is not done, they are party to a policy which will have very serious consequences for the poultry industry. The present prosperous period is of a transitory nature, and as soon as times have reverted to normal again, only healthy well-bred flocks will be able to withstand competition successfully.

Useful Hints for Poultrymen.

Sacking makes servicable walls for poultry houses. Old grain bags are cut open along the seams and nailed tightly on to the outside framework, with clout nails, and the joints neatly sewn together. When complete, the sacking is thoroughly soaked with water and the following mixture applied with a brush, giving one coat on the inside and two or more on the outside.

Mixture: Water $1\frac{1}{4}$ gallons; cement 12 lb.; lime 2 lb.; salt 1 lb.; alum $\frac{1}{2}$ lb. Sieve the lime and salt to break up lumps, add the water then the cement, stirring while adding, add the alum last. Select a dry, cloudy day for the application of the mixture. The second and subsequent coats must be applied when the former is wind-dry. It is known that such houses have given good service for a number of years. This material is also satisfactory when used on pitched roofs.

[E. F. Lombard, Prof. Officer (Poultry), East London.]

Good Housing for Improved Egg Production.

P. E. F. Jooste, Professional Officer (Poultry), Port Elizabeth.

IN view of the limited available supplies of poultry feed maximum egg production has become essential. Maximum egg-production, however, is also largely dependent on good housing and this is a fact which many poultry farmers do not yet realize. On the other hand, many farmers provide suitable houses but keep an excessive number of hens in them, with the result that hygienic conditions

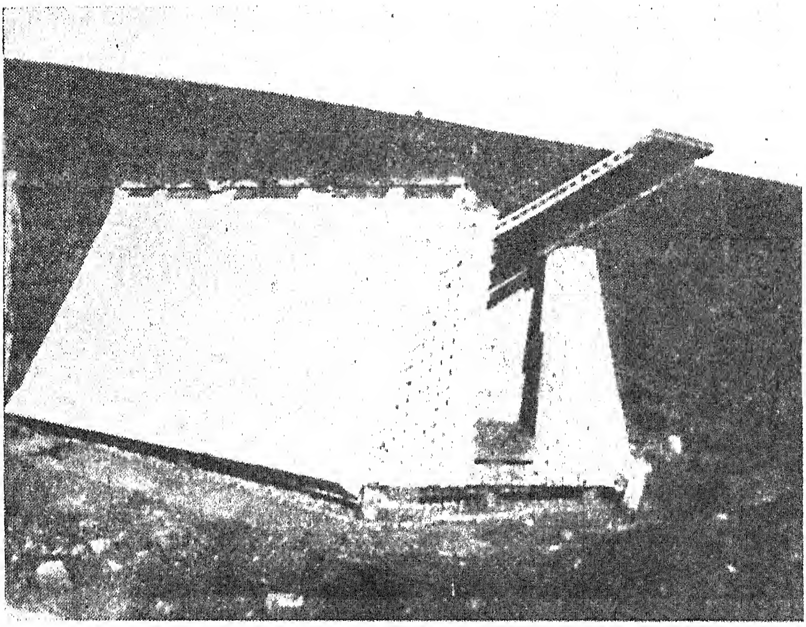

FIG. 1.—Ark or triangular type of house in position. Note the trellised front.

deteriorate and production and growth suffer. Drastic improvement in poultry housing is necessary especially on farms where systems of general farming are applied and where small flocks of fowls are kept.

A poultry house suitable for growing chicks or for laying hens should comply with the following requirements viz., it must be (1) economical, (2) comfortable, (3) sunny, (4) dry, (5) well ventilated, (6) roomy, (7) protected against extremes of temperature, and (8) easy to clean.

The lean-to type of house, adapted in various ways to different surroundings is widely used in intensive or semi-intensive systems. The intensive system of housing is preferable, since it enables a more effective application of health measures, in case of an outbreak of infectious disease.

The Ark Type of Portable House.

The Ark type of house, sometimes also called the triangular house, has lately become popular with many poultry farmers. This

type of house is movable, and is excellent for young birds. Where space permits, the structure can be transferred to clean ground every year. Disease-infected ground can then be cleaned thoroughly and, if possible planted to some crop or other.

The following is a description of the houses shown in the accompanying illustrations—

The total height of the structure is 5 feet, and its width at the base 6 feet 6 inches. The sides are 8 feet 6 inches long. The house is raised 4 to 5 inches from the ground, the height of the roosting

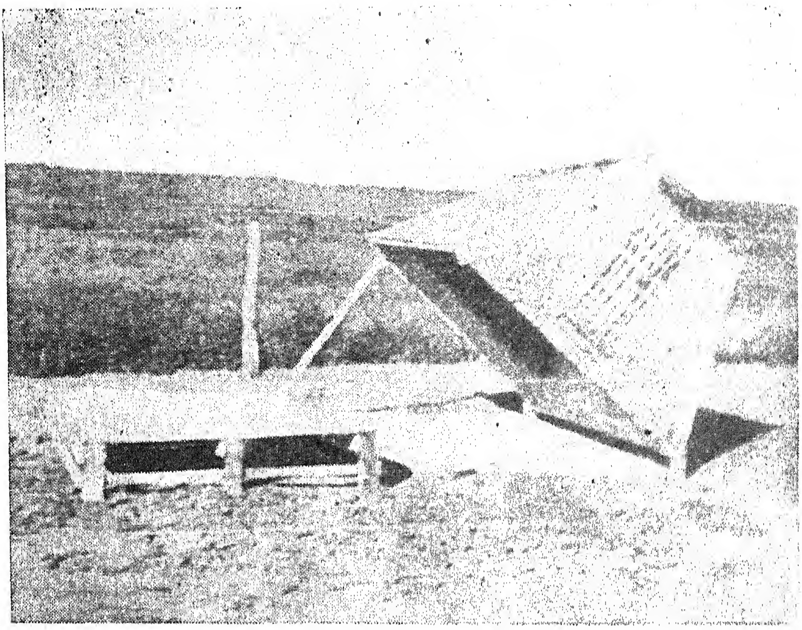

FIG. 2.—The sleeping platform is unattached and can easily be moved.

perch being from 12 to 14 inches. The roosting perch or frame is constructed of wire netting (½ inch mesh) or of wooden slats spaced ¾ to 1 inch apart. It is essential to make the roosting frame strong enough to bear the weight of a human being, since it is necessary to enter the house from time to time to handle the birds. The measurements of the house may vary according to the number of birds to be housed in it. Large houses are not recommended, being too heavy to move.

Fresh air enters from underneath the structure and the hot stuffy air rapidly produced by the breathing of birds, escapes from the highest point of the roof in front. The owner of these houses has found that when openings are left along the entire length of the roof the birds are inclined to catch cold. Where the hot air escapes only at the front, however, and the fowls sleep at a height of from 12 to 14 inches above the floor, they are in no direct draught.

The house is designed solely as sleeping quarters and to provide shelter during unfavourable weather. Water is provided outside the house in a shady spot, and mash is fed to the birds in waterproof and ratproof hoppers. If the house is to be used also for laying hens, waterproof nests must be provided.

The houses are mostly made of deal boards, with the sides and back air-tight. The front should allow the free passage of air. Treat the wood against parasite infestation before constructing the house, and repeat the treatment at intervals. Other material which happens to be available, may also be used.

Mr. H. E. Green of Alexandria, has been succesful in keeping more than a thousand birds in such houses in groups of 50 to each

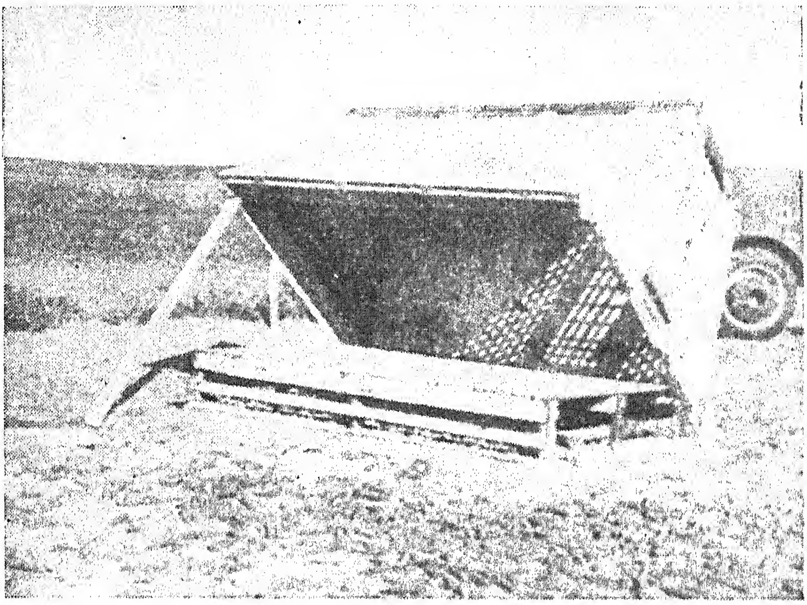

Fig. 3.—One side of the house can be raised for cleaning purposes. Note the framework serving as a sleeping perch for the birds.

house. His houses are not movable, however, and rest on cement floors. On one side the house is attached to two poles by means of iron pegs which function as hinges when the other side of the house is raised for cleaning purposes.

This type of house is specially recommended for rearing pullets after they have been removed from the brooder-house, and until they reach the laying stage. It is also very suitable for the rearing of cockerels for slaughter or breeding purposes.

The most serious disadvantage attached to these houses is the occasional occurrence of losses due to theft and the depredations of wild animals, even when the houses are locked at night.

Hints for the Poultry Farmer.

Green yolked eggs are mostly layed after the winter or a severe drought. This condition is chiefly caused by the birds eating an excess of green feed, particularly such as all the varieties of the cabbage family or very succulant green lucerne. The addition of 3 per cent. of charcoal powder in the mash of laying hens, helps very considerably to prevent this undesirable condition in eggs.

Red-mite.—If all perches and perch joints are well brushed with sump oil once a month, red-mite will not trouble the poultry.

[E. F. Lombard, Professional Officer (Poultry), East London.]

The Nutritive Value of Casein.

Dr. B. J. Smit, Stellenbosch-Elsenburg College of Agriculture.

IN the home casein is not such a well-known constituent of milk as butterfat. Nevertheless, it is one of the most important and useful constituents of milk. Just like meat, casein is a protein and can be called the "meat" of a milk dish. Protein is an indispensable ingredient of the feed of animals, since it is the principal constituent of the protoplasm which forms the vital portion of all living cells.

Like all other proteins, casein can be split up by hydrolysis into amino-acids, the "links" or "bricks" out of which it is composed. In the process of digestion a protein can be broken up into amino-acids which are assimilated by the animal body and utilized for building up a protein of a different form in the body of the animal.

To-day at least twenty three such amino-acids are known. Two such amino-acids can be combined to form a simple protein; the larger the number of amino-acids combined, the more complex does the resultant protein become. It might therefore happen that the protein being fed does not contain all the amino-acids necessary for building up the body proteins. Consequently, the animal will not grow as rapidly as it should, since some of the missing amino-acids cannot be synthesized fast enough in the animal body. Such amino-acids are called essential amino-acids.

Value of Protein Feed.

The object of effective protein nutrition should therefore be to feed all the proteins from different sources together in such a manner that the deficiencies of essential amino-acids in one are covered by the surplus in the other proteins. Consequently, a food possesses the highest protein value when the proteins are of such a nature that it provides all the necessary amino-acids in such proportions as occur in the new protein which must be built up in the animal body. The value of protein for human and animal nutrition therefore depends upon the kind of amino-acid present and so explains why certain proteins are eminently suited to feeding purposes while others are practically worthless in themselves. In times of protein scarcity especially, it is of the greatest importance that we should know which proteins are suitable for the purpose for which we intend to use them so that we can avoid wasting money on something which will not serve its purpose. Even in normal times the protein portion of a feed is the most expensive part.

Value of Casein.

Fortunately, casein is one of the natural proteins which contains all the necessary amino-acids of the proper kind and quality and in the correct proportions for sufficiently rapid conversion in the animal body into proteins which the body requires for normal growth. Casein is therefore described as "complete." In addition to amino-acids, casein also contains phosphorus and is therefore classed as a phospho-protein. Up to 90 per cent. of the phosphorus in casein is utilized by the animal body. Casein is an important constituent of the milk of all animals; no other protein in nature can take its place.

The fact that 80 per cent. of the milk protein consists of casein gives milk a still more effective nutritional value. Of the milk protein from 97 to 98 per cent. is digested in the animal body, while only 92 per cent. of the proteins usually present in the diet are

digested. Milk protein is an important source of tryptophane and is particularly rich in lysine, two amino-acids which are generally lacking in plant protein. For this reason, milk protein is not only efficient but also valuable owing to the effective manner in which the shortages of the missing amino-acids in the cereal protein of bread, oatmeal, mealiemeal and other cereal foods are made good.

Value of Skimmed Milk.

Milk has a high protein content as compared with its carbohydrate content. This makes milk a valuable food for use in preparing a diet. Where too little protein of good quality occurs in our food owing to a protein shortage, the deficiency may be made good by the inclusion of milk or milk dishes in the diet. The high quality of the milk proteins and their value in supplementing the other proteins in the diet has led to the recommendation that liberal use should be made of milk and milk dishes in our daily diet.

Owing to its casein content, as well as its vitamin, milkfat, lactose and mineral salt content, milk is a more valuable food than ever during the abnormal conditions which prevail in time of war. In view of its casein content, not even buttermilk should be thrown away. If humans cannot drink all the buttermilk produced on the farm, the surplus may be fed to animals.

The dairy farmer knows the value of casein in the form of skimmed milk as feed for growing animals. He knows too that the nutritive value of skimmed milk lies mainly in its inexpensive source of feed of high quality and that the casein which it contains, is easily digestible. Experience has also taught him that the casein in skimmed milk compensates for the shortcomings of cereal feeds. Growing animals should therefore receive sufficient skimmed milk to satisfy their protein requirements, but to feed more skimmed milk than is necessary to meet their protein requirements, especially in times of protein scarcity, is merely a waste of precious protein. If the feed protein is of low quality, calves which are being reared on skimmed milk should be given larger quantities of the latter in order to compensate for the deficiencies in quantity and quality of the essential amino-acids, but if the calves receive adequate quantities of high quality legume hay together with a suitable grain ration, less skimmed milk need be fed. Even larger young animals grazing on veld will derive benefit from the casein present in skimmed milk.

The pig farmer also knows that skimmed milk is the cheapest feed for producing pork and bacon. Dairy farming and pig farming go well together. The poultry farmer who rears chicks fully realizes the importance of skimmed milk as feed for his birds, not only because skimmed milk is the cheapest and most useful source of Vitamin G (riboflavin) which is necessary for growth and hatchability, but also because it contains casein which is so readily digested and of such high quality for poultry.

Nutritive Value of Cheese.

In every one of the more than 450 kinds of cheese which are made from milk, the casein is present in still more concentrated form than in milk, skimmed milk or buttermilk. The fact that casein is subject to hydration under the action of acids or rennet or both, and assume a curdled form, makes it possible for the milk to be drained of its excess moisture to produce a concentrated food which may be stored for later use and transported over long distances in the form of cheese.

Although cheese is known in one form or another in every home, it is still regarded as an extra, almost as a delicacy, instead of as one of the most important foods comparable with meat or eggs. From an economic point of view, and also from the point of view of its high nutritive value, much greater use should be made of cheese than is at present the case.

Cheddar cheese contains at least 29 per cent. protein, mainly casein, while soft cheese which is prepared from skimmed milk, contains more than 23 per cent. casein. The protein content of 1 lb. Cheddar cheese is equivalent to that of 1½ lb. of beef or almost that of 2 lb. of chicken. One ounce of Cheddar cheese is roughly equivalent to one egg, or one glass of milk, or two ounces of meat. In times of protein scarcity it is of the utmost importance that all milk which is not used for human and animal nutrition, should be converted into one form of cheese or another in order to supplement other sources of protein foods which are in danger of becoming exhausted. If we were to substitute cheese dishes for meat on only one day of the week, this would mean a reduction of one seventh in the number of stock slaughtered, while the nation would still be provided with the necessary protein of good quality.

There are hundreds of recipes for using cheese in the preparation of suitable dishes. Much greater use could be made on the farm of soft types of cheese like cream cheese, gervais and cottage cheese since they are easy and cheap to make. On every farm milk or skimmed milk should be available for this purpose. Grass, etc., which cannot serve as human food, can be efficiently converted into excellent food by the cow. The inexpensive but valuable protein, casein, in cottage cheese or other types of soft cheese takes the place of the more expensive and perhaps scarcer protein in the diet, and is therefore performing a national service.

Cottage cheese is richer in protein than most kinds of meat and is very much cheaper. Every pound of cheese contains more than 3 ozs. of protein, the source of nitrogen for building up the body. Food which is intended as a substitute for meat must be rich in protein and fat. Cheese is rich in the same nutrients as are provided by meat and can therefore easily be used to replace meat. Cheese can also be served in different forms, and where this article must take the place of meat on the menu, the cheese dish should be prepared in such a way as to suit the taste of the consumer. Casein in the diet means economy and its inclusion is a sure means of promoting health.

Some Hints on Poultry Farming.

Preventing draughts in fowl-houses.—One of the chief causes of colds and roup in poultry is a draughty fowl-house. The roof should fit closely on the side walls. An opening of 3 to 4 inches must be left between the whole length of the back wall and the roof. To prevent side draughts in a long house, there should be a solid division every 25 feet from back to front, fitting the roof closely. Of great importance is the provision of ventilation below the perches, at intervals of 5 to 6 feet, an air-brick or similar substitute should be placed in the back wall, 6 inches from the floor. Outside a baffle plate (a piece of wood or flat iron) is placed over the air-brick, leaning against the wall, 6 inches above the top of the air-brick, projecting 6 inches on either side and resting on the ground 6 inches from the wall.

[E. F. Lombard, Professional Officer (Poultry), East London.]

The Farm Home.

(A Section devoted mainly to the interests of Farm Women.)

The Value and Use of Apples.

Misses S. J. van Schalkwyk and S. Snyman, Home Economics Officers, Department of Agriculture and Forestry, Pretoria.

THE apple, frequently referred to as the " King of Fruits ", does not owe its popularity to its appearance and taste only; more important still are its valuable regulatory and body building properties.

Relative Value of Apples and Milk in the Diet.

Apples and milk contain the same constituents but in different proportions. Nevertheless these two important foodstuffs can supplement each other very effectively in respect of bulk, proteins and fats, as appears from the following table.

	Per Cent. Water.	Per Cent. Protein.	Per Cent. Fat.	Per Cent. Carbohydrates.	Per Cent. Minerals.	Milligrammes per Ounce.			Vitamin Units.			
						Calcium.	Phosphorus.	Iron.	A.	B.	C.	G.
Apples.......	84·1	·3	·4	14·9	·29	2	3	·1	23	7	1·7	6
Milk.........	87·0	3·5	3·9	4·9	·7	34	27	·07	47	6	Very little	17

Apples and milk may, therefore, be combined in the diet with very beneficial results, e.g. baked apples with custard.

Mineral Salts.—Calcium, phosphorus and iron are essential minerals for the body. Calcium builds bones, assists in regulating the heart-beat and is responsible for imparting to the blood some of its congealing properties. Phosphorus constitutes a part of every living cell in the body and iron is necessary for the formation of red blood corpuscles.

Vitamins.—All the vitamins contained in apples are important for growth and general health. They raise the resistance of the body and protect it against disease. Apples supplement the deficiency of vitamin C in milk and the acid present in this fruit minimizes the destruction of this vitamin during cooking.

Bulk.—The indigestible fibres in the apple, together with the natural acid and vitamin B which it contains, assist in keeping the body clean, by stimulating the action of the digestive organs and preventing constipation.

Like most fruits, apples do not form an acid in the system, but a base which counteracts the acids generated by cereals, sugars and meat foods.

Cooking Properties of Various Kinds of Apples.

At least 1,000 different varieties of apples are cultivated in various parts of the world. About 400 varieties have been tested out in South Africa and most of these appear to thrive in our climate.

The following are the commonest varieties grown in this country:—

1. Early—Sharp's Early, Williams' Favourite, Carrington.
2. Midseason—Jonathan, Cleopatra, Missourie Pippin.
3. Late—Delicious, Versfeld, Rome Beauty, Ohenimuri, White Winter Pearmain, York Imperial and Reinette de Canada.

Cooking apples are generally sour and hard and not very suitable for use in the raw state.

Some apples retain their shape when cooked in water or syrup; some are inclined to become pulpy, others shrink, and certain varieties fall to pieces.

Sweet apples usually retain their shape whether cooked in syrup or water, while sour apples are inclined to fall to pieces during the process. The following varieties retain their shape when cooked:—

Ohenimuri, Versfeld, Cleopatra, Reinette de Canada.

Apples may be served raw or cooked with any meal. For breakfast they may be served raw or baked or in the form of apple pulp.

Baked Apples.—Wash the apples and remove the core with an apple-corer. Fill with sugar, honey or a date; flavour with cloves or cinnamon and bake in a baking dish. Bake slowly in order to ensure softening of the skin. If served as a breakfast dish no sugar need be added, or if at all, only a small quantity, since the acid in the fruit promotes digestion.

Apple pulp.—Pare the apples thinly and core. Cut into small pieces and boil in water until soft. Add sugar to taste and remove from fire. The addition of a little lemon juice or spices will improve the flavour. Apple pulp should have the consistency of porridge, with a sour-sweet taste and a light colour.

Apples may be prepared for lunch or supper in a variety of ways, e.g., as a fruit cocktail served at the commencement of the meal, as a salad dessert or as a fruit drink.

FRUIT COCKTAIL.

1 c. orange juice.
½ c. lemon juice.
1 c. pineapple cubes.
A few glazed cherries.
1 c. diced apple.

Mix the orange and lemon juice. Sweeten to taste, but allow mixture to retain an acid tang. Cut apples into small cubes and immediately mix with fruit juices to prevent discoloration. Add pineapple cubes. Keep in a cool spot.

Serve in champagne or ice-cream glasses and garnish with a cherry.

APPLE SALAD.

1 c. apples (diced).
1 c. celery (cubes).
Lettuce leaves.
½ c. finely chopped walnuts
Salad dressing.

Mix the apples, celery and nuts with any salad dressing. Serve on lettuce leaves.

SALAD COMBINATIONS.

1. Finely sliced cabbage and apple mixed, with salad dressing and lettuce leaves.
2. Apple, groundnuts, chicken, salad dressing and lettuce leaves.
3. Apple, dates and nuts with sour cream dressing on lettuce.
4. Apple, bananas and dates with dressing, on lettuce.

APPLE AND RAISIN SALAD.

Mix stewed dried apples with salad dressing and raisins. Serve on lettuce leaves or as preferred.

APPLE TART.

2 c. flour.
12 T. butter.
½ T. sugar.
1 egg.
1t. baking powder.
½ T. water.

Method:

1. Rub the butter into the flour. Add sugar and baking powder.
2. Beat the egg, add water and mix with dry mixture (fairly stiff).

Filling.

2 medium-sized apples.
8 cloves.
¾ c. sugar.
3 eggs.
1 c. butter.
2 T. raisins.
½ c. chopped walnuts.
A little brandy.

Method:

1. Stew apples until soft, with sugar, butter and cloves. Stir to prevent burning.
2. Remove cloves.
3. Add raisins and nuts.
4. Beat yolks and whites of eggs separately and add. Add brandy.

Roll crust out thick and line the bottom and sides of plate with it. Pour fruit mixture in and bake in a moderate oven for about 30 minutes.

APPLE CAKE.

Apples.
1¾ c. flour.
8 T. butter.
6 T. sugar
1 t. baking powder.
1 egg.
Pinch of salt.

Method:

1. Beat butter and sugar into a cream.
2. Add egg and beat well.
3. Sift flour, baking powder and salt together and add.
4. Stir well and place half the dough into a greased baking pan.
5. Place cooked apples on top and cover with remaining half of dough.
6. Bake in moderate oven until light brown.

HONEY APPLES.

1 c. honey or moskonfyt.
6 apples (preferably sour apples).
½ c. water.

Method:

1. Pare and core apples.
2. Boil honey and water and insert apples. Allow to stew slowly, turning apples from time to time, to ensure thorough cooking.
3. Remove apples when soft and boil liquid until it begins to thicken.
4. Pour liquid over apples.
5. Serve with cream or custard for dessert.

Preserving of Apples.

Apples may be preserved for future use in several ways.

(1) They may be canned whole, or cut up into desired shapes. Pare sound apples, remove core and immerse in acid or salt-water to prevent discoloration. Then immerse fruit in boiling water for 2 minutes and subsequently in cold water. Pack the fruit firmly without crushing into clean, sterilized jars. Fill immediately with a previously prepared syrup made of 2 c. water to each cup of sugar. Place rubber rings in position and partially seal jar. Sterilize for 12 minutes just below boiling point. Seal and allow to cool.

(2) Apples may also be preserved in the form of apple sweets, apple butter or dried apples.

(3) This fruit also plays an important rôle in jam and jelly-making, owing to its high pectin content. A combination of fruits with a stronger flavour or with a low acid content, with apples, makes a delicious jelly.

Use sour apples, wash thoroughly and remove the flower-ends. Do not pare. Cut into pieces. The skin and pips contain a large

quantity of pectin. Add just sufficient water to cover and boil slowly in a covered saucepan until soft. Strain through a thin cloth or sieve, and then through thick flannel cloth.

The juice is now ready for use, either alone or combined with other fruit juices, for making jelly or fruit drinks. If used for jelly, a test must be carried out to determine the pectin content. Take 1 T. previously prepared cold juice and add to 2 T. methylated spirits in a glass. Leave undisturbed for a little while. Then pour contents into a saucer; the formation of a firm lump of jelly indicates a high pectin content and in this case equal quantities of sugar and juice should be used. If, however, the lump is not firm, ½ to ¾ c. sugar should be used for each cup of juice.

Bring the juice to boiling point in a flat saucepan and add sugar. Stir carefully until sugar is dissolved and boil rapidly until the syrup sets when dripped from a wooden spoon. Pour immediately into dry, hot, sterilized jars, allow to cool, place a layer of paraffin wax or paper dipped in brandy on top, and seal.

Apple Butter and Apple Sweets.—The apple pulp which remains after the juice has been extracted may be utilized for making apple butter or sweets. The addition of lemon juice will improve the flavour.

For apple butter add ¼ c. sugar for every cup of pulp. When the sugar has melted, boil until it has the consistency of freshly made butter. Place mixture in sterilized jars and seal tightly.

For apple sweets, use ½ c. sugar for every cup of pulp and boil until the mixture comes away from the sides of the pot. Stir to prevent burning.

Pour mixture out into pans lined with greased butter-paper. Allow to stand for 3-4 days. Then cut into desired shapes, place on wire trays to dry thoroughly. Roll in sugar and store between butter paper in tins or jars.

Apple Jam.—Apples may also be used for jam-making. In this case the apples are pared, left whole or cut up into small slices. Core, if desired. Prevent discoloration as indicated above. Place the fruit in boiling water and boil until soft. It is desirable to use apples which retain their shape. Allow water to drain off well, strain and use the same water for making the syrup. Use 1 lb. sugar for every lb. of fruit and 4 c. water for every lb. of sugar. Bring syrup to boiling point and add fruit slowly. Boil rapidly until fruit is clear and the syrup thick. A few slices of lemon and a few cloves may be added while the mixture is boiling, to improve the flavour.

REFERENCES.

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Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 JULY 1943 No. 251

CONTENTS

* Price Review for May, 1943.

SLAUGHTER STOCK.—As a result of the shortage of meat, a scheme of meat rationing to butchers came into force in the Witwatersrand and Pretoria areas at the beginning of the month, and in the Durban area from about the middle of the month. Butchers are thus supplied with a quota, based on their normal sales. Towards the end of the month a commencement was also made on the Johannesburg market to base sales on a live weight basis instead of per head. The demand on the whole was lively on all markets and cattle and sheep sold at maximum prices in most cases.

Grains.—Supplies of maize and maize products remained exceptionally scarce. Supplies of the previous season were practically exhausted, while the wet weather prevented farmers from harvesting the new crop. Only towards the end of the month smaller quantities began to arrive. This was also the case with kaffircorn where the rain in the kaffircorn areas delayed the harvesting and marketing of the crop. Average prices for the month were more or less the same as for the previous month, viz., 21s. 8d. per bag free-on-rail for K1. and K2.

Dry Beans.—The rainy weather also retarded the harvesting and marketing of dry beans, so that only smaller supplies were on hand which caused prices to rise. Speckled sugar beans, e.g., were 41s. 6d. per bag on the Johannesburg market as against 35s. 7d. per bag for April, and kaffir beans rose from 27s. 1d. per bag to 28s. 3d. This, however, was only a temporary shortage and as soon as bigger supplies of the new crop will become available prices ought to recede again.

Hay.—Offerings lucerne hay decreased to quite an extent during the month and maximum prices were realized in most cases. Oat hay was exceptionally scarce, but fair quantities of teff grass were offered on the Johannesburg market.

Potatoes.—Supplies decreased to quite an extent owing to weather conditions and other winter activities on the farms. Prices

* All prices mentioned are average.

everywhere showed further advances, although National Mark potatoes rose less than others. Transvaal No. 1 on the Johannesburg market rose from 11s. 5d. to 12s. 6d. per bag for May, and National Mark Grade 1, No. 2 and 3 from 15s. 8d. and 15s. to 15s. 11d. and 15s. 5d. respectively. Cape No. 1 on the Cape Town market rose from 13s. to 15s. 6d. and Natal No. 1 on the Durban market from 14s. 7d. to 16s. 3d.

Onions.—Supplies of Cape onions increased on the market, but supplies, nevertheless, were small and prices on the whole advanced. Cape onions on the Johannesburg market rose from 12s. 10d. to 15s. 8d. per bag for May, and on the Cape Town market from 9s. 10d. to 13s. 2d.

Tomatoes.—Supplies on most markets decreased gradually during the month and prices increased. On the Johannesburg market National Mark No. 1 tomatoes realized 4s. 10d. per tray as against 3s. 4d. for April, and ordinary tomatoes 2s. 6d. as against 1s. 7d.

Vegetables.—Supplies of vegetables, especially of green beans, green peas and squashes came largely from the Transvaal Lowveld. Nevertheless vegetables in general were very scarce and, as a result, very dear.

Fruit.—Offerings of deciduous fruits decreased much during the month and prices rose. Oranges, and especially navels, were the most important fruit on all markets, while naartjies were also very abundant. Prices were on a lower level, while towards the end of the month the price fixation scheme for citrus fruits came into operation. The following maximum retail prices per pocket for citrus fruit in the Cape Town, Durban, Witwatersrand, Pretoria and Port Elizabeth areas were fixed: for oranges and grape fruit, 3s. 3d., 3s. and 2s. 9d. for 1st, 2nd and 3rd grade, respectively; and for lemons, 3s. 9d., 3s. 6d. and 3s. 3d. for 1st, 2nd and 3rd grade respectively. Maximum quantities that may be sold at 1s. were also fixed.

As regards tropical fruit the supply was reasonably good. Especially consignments of grenadellas and avocado pears were bigger and prices lower, while pawpaws were also well supplied.

Eggs.—Supplies remained small and prices as a result, rose further, e.g., on the Johannesburg market new laid eggs advanced from 3s. 3d. per dozen for April to 3s. 10d. for May and fresh eggs from 2s. 9d. to 3s. 5d., while on the Durban market new laid rose from 3s. 11d. to 4s. 10d.

Index of Prices of Field Crops and Animal Products.

This index, as shown elsewhere in this issue, shows an exceptionally sharp increase during the month, viz., from 148 in the previous month to 156.

As regards the various groups of products from which the index is constituted, the following groups show the most important advances:—

(*a*) Summer Cereals.—The index hereof rose from 159 to 169 as a result of the higher prices for mealies of the new crop, viz., 16s. per bag free-on-rail for the best grades as against 15s. per bag the previous season.

(*b*) Other Field Crops (i.e., potatoes, sweet potatoes, onions and dry beans) which advanced from 140 to 155.

(*c*) *Dairy Products.*—This index increased from 139 to 163 in May, caused by the subsidy of 3d. per pound on all grades of butter-fat delivered to creameries by producers and which is paid by the Dairy Industry Control Board; and a subsidy of 2d. per gallon on all cheese milk delivered to cheese factories, as well as the increase in the fixed price of milk for condensing purposes from 10d. per gallon to 1s. per gallon from 1st May 1943 (for further particulars in this connection see May 1943 issue of *Crops and Markets*).

(*d*) *Poultry and Poultry Products.*—This index rose from 262 to 316 in May, as a result of the scarcity of eggs.

The Argentine Maize Crop.

ACCORDING to the representative, Barclays Bank, Ltd., Buenos Aires, Argentine, the first official estimate of the present Argentine maize crop has now been announced, being 1,900,000 ton. This is only about 24 per cent. of the average yield of the past five seasons, which were as follows:—

Year.	*Ton.*
1937-38	4,424,000
1938-39	4,864,000
1939-40	10,375,000
1940-41	10,238,000
1941-42	9,034,000

This exceptionally weak yield is due to the extraordinary severe drought during the past season and partly as a result of the policy to plant less mealies during this season in order to ease the position in connection with the accumulated supplies.

During the previous three seasons, the production was exceptionally high, as appears from the above figures. Because the normal export could not take place on account of the difficulties arising as a result of the war, the Government was compelled to step in, in order to save producers from financial ruination. The whole crop was purchased at a minimum price and large supplies thus accumulated. The biggest difficulty in this connection was the question of storing the supplies, with the result that considerable quantities deteriorated, so that of the old crop, according to the latest information, only about 1·6 million ton of the existing stocks still remain, which is suitable for consumption. The joint effect of all this was that the Argentine, which is normally a big exporter of mealies, to-day has a shortage in this respect

Besides the maize crop and the yield of other summer crops, the drought also affected the animal husbandry enterprise and especially the cattle herds. Apart from the direct loss of about 6 million head of cattle, the enterprise has also been caused an exceeding amount of indirect damage, for example, a decrease in the production of dairy products and the detrimental effect which it will have on this year's calf crop. Especially the latter will have a very far reaching effect on the cattle enterprize.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39 = 100.)

SEASON (1st July to 30th June).	Summer Cereals. (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Stock. (e)	Dairy Products. (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936-37	118	86	94	93	122	86	89	98	106
1937-38	89	106	112	118	98	112	105	107	101
1938-39	92	107	96	89	79	102	106	94	93
1939-40	86	106	77	93	116	105	106	89	104
1940-41	109	113	106	159	103	108	110	112	109
1941-42	121	132	145	205	101	131	134	163	124
1942—									
January	131	137	126	180	100	122	144	141	125
February	132	138	125	168	101	130	140	147	125
March	126	140	140	175	101	130	134	168	125
April	126	139	151	170	102	130	129	175	125
May	158	139	188	181	102	154	132	203	136
June	159	139	207	186	101	154	140	218	138
July	159	140	183	184	160	167	154	163	143
August	159	139	181	175	115	167	155	130	140
September	159	139	182	191	115	167	176	133	145
October	159	139	156	227	115	167	181	141	147
November	160	154	134	189	115	139	187	146	147
December	160	154	123	137	115	139	178	158	144
1943—									
January	160	154	132	113	115	139	165	150	141
February	163	154	130	112	115	139	156	179	142
March	161	154	142	119	115	139	160	216	145
April	159	154	142	140	116	139	163	262	148
May	169	154	144	125	116	163	165	316	156

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay.
(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins.
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls, turkeys and eggs.

* Preliminary.

Average Prices of Maize, Kaffir-corn and Dry Beans per 200 lb.

SEASON AND MONTH.	MAIZE. F.o.r. Producers' Stations. No. 2. Bags.	No. 2. Ex Elevator.	No. 6. Bags.	No. 6. Ex Elevator.	Cape Town Consumers' Price F.o.r. No. 6 in Bags.	KAFFIRCORN F.o.r. Producers' Stations. Bags, K. 1.	Bags, K. 2.	DRY BEANS Johannesburg (Municipal Market). Speckled Sugar.	Cow Peas
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	8 7	8 6	8 6	8 8	13 2	13 1	12 9	25 0	16 9
1940-41	9 2	8 8	9 3	8 9	14 0	15 6	17 0	30 0	16 8
1941-42	—	—	—	—	—	—	—	32 10	19 8
1942—									
January	11 0	10 1	10 10	9 4	14 9	21 5	22 3	34 4	21 9
February	11 0	—	11 0	—	14 8	21 11	22 11	32 7	20 11
March	10 6	—	10 6	—	14 9	20 2	21 1	30 10	19 2
April	10 6	—	10 6	—	14 10	18 5	18 9	32 6	25 5
May	15 0	—	15 0	—	15 6	20 8	20 8	32 8	26 4
June	15 0	—	15 0	—	17 6	21 11	21 11	33 5	26 5
July	15 0	—	15 0	—	17 7	21 8	21 8	33 7	24 8
August	15 0	—	15 0	—	17 8	22 10	22 10	36 7	27 2
September	15 0	—	15 0	—	17 7	24 6	24 6	38 1	28 4
October	15 0	—	15 0	—	17 9	24 8	24 8	39 0	27 6
November	15 0	—	15 0	—	17 10	25 0	25 0	38 6	27 1
December	15 0	—	15 0	—	17 11½	25 0	25 0	37 3	22 7
1943—									
January	15 0	—	15 0	—	18 6	27 3	27 3	33 7	21 4
February	15 0	—	15 0	—	19 2	34 2	34 2	30 1	22 8
March	15 0	—	15 0	—	19 6	29 6	29 6	34 8	26 3
April	15 0	—	15 0	—	—	21 7	21 0	35 7	27 1
May	16 0	15 3	16 0	15 3	—	21 8	21 8	41 6	28 3

Seasonal year for maize and kaffircorn, 1st June–31st May; for dry beans, 1st April–31st March.

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb. (a) Johannesburg. N.M. Prime.	Ordinary Prime.	Good Medium.	Compounds.	(b) Durban. Medium.	Compound.	Pigs per lb. Live Weight. Johannesburg. Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938–39.........	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940–41.........	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941–42.........	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942—									
January.......	62 3	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February......	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March.........	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April..........	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May...........	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June..........	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July..........	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August........	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September.....	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
October........	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November.....	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December......	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1 43—									
January.......	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February......	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March.........	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2
April..........	65 6	60 8	55 8	43 4	42 1	33 11	6·9	9·1	6·5
May...........	65 0	59 11	55 3	43 9	42 6	37 6	7·6	8·7	6·6

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June tp 31st May).	Johannesburg. Merino Wethers. Prime.	Medium.	Persians and Cross Breds. Prime.	Medium.	Cape Town. Merinos. Prime.	Medium.	Capes and Persians. Prime.	Medium
	d.	d.	d.	d.	d.	d.	d.	d.
1938–39.........	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940–41.........	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941–42.........	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942—								
January.......	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February......	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March.........	9·6	814	8·8	7·9	9·6	8·8	9·3	8·8
April..........	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May...........	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June..........	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July..........	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August........	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September.....	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
October........	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November.....	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December......	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January.......	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·4
February......	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·1
March.........	14·5	9·8	9·0	7·3	11·7	10·6	11·1	10·2
April..........	12·0	10·2	9·5	7·7	12·4	10·9	11·6	10·8
May...........	12·0	10·3	9·6	7·9	11·1	10·1	11·1	10·3

* As sold on the hoof. Reported by Meat Control Board.

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

SEASON (1st July to 30th June).	CABAGES (Bag). (a)			CAULIFLOWER (Bag). (a)			TOMATOES (Trays 15 lb.).			
							Johannesburg.			
	Johannesburg.	Cape Town.	Durban.	Johannesburg.	Cape Town.	Durban.	N.M. No. 1.	Other.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39.........	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940-41.........	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941-42.........	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1942—										
January.......	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February......	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March.........	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April:	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May...........	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June..........	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July..........	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August........	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
September.....	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
October........	4 2	6 10	2 5	—	4 9	5 5	2 6	1 5	2 0	1 4
November.....	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10
December......	3 11	7 10	3 2	—	4 0	—	3 8	1 10	3 0	2 4
1943—										
January.......	5 1	9 0	12 6	—	—	—	4 11	2 4	2 6	2 8
February......	6 4	10 2	15 2	5 7	5 8	—	5 5	2 7	1 8	2 11
March.........	5 6	9 6	8 6	6 6	5 11	—	3 11	1 9	1 10	2 7
April..........	4 1	9 5	8 1	3 2	6 1	7 4	3 4	1 7	2 2	3 1
May...........	4 5	6 0	7 9	3 10	5 0	7 0	4 10	2 6	2 3	2 6

(a) Weights of bags vary, but on the average are approximately as follows: For cabbages: Johannesburg, 105 lb., Cape Town 105 lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 65 lb., and Durban 85 lb.

Average Prices of Oranges and Pawpaws

SEASON (1st April to 31st March).	ORANGES (Pocket).							PAWPAWS (Standard box).	
	Johannesburg.			Cape Town.		Durban.		Johannesburg.	
	N.M. Navels.	Other. Navels.	Other. Valencias.	Navels.	Valencias.	Navels.	Valencias.	N.M.	Other.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39.........	1 10	1 6	1 5	2 0	2 1	—	—	2 0	1 7
1940-41.........	1 9	1 7	1 6	1 11	1 10	2 4	2 1	2 2	1 9
1941-42.........	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1942—									
January.......	—	2 6	3 8	2 10	4 7	—	3 11	3 3	2 1
February......	—	3 11	4 5	4 7	6 10	3 9	5 8	6 4	3 3
March.........	—	3 7	2 11	6 6	5 10	4 8	5 6	4 1	3 1
April..........	2 1	2 0	1 10	3 4	5 0	3 4	2 6	4 0	3 1
May...........	2 4	2 3	2 1	2 3	2 3	2 6	1 2	3 8	3 1
June..........	2 3	2 3	1 9	2 1	—	2 6	1 11	2 11	2 5
July..........	2 5	2 5	1 11	2 1	—	2 8	1 0	2 8	2 2
August........	2 11	2 8	2 3	3 0	2 4	3 6	2 4	2 2	1 8
September.....	2 5	3 3	2 3	3 4	2 2	4 0	2 6	2 1	1 6
October........	2 9	2 11	2 7	5 1	3 1	3 7	2 11	2 4	1 9
November.....	—	3 6	4 0	6 11	3 7	4 6	3 6	3 1	2 6
December......	—	3 1	3 8	2 11	4 3	—	4 2	3 5	2 1
1943—									
January.......	2 0	3 8	4 0	—	4 10	2 4	3 9	3 9	2 0
February......	7 1	5 8	5 3	—	7 6	—	4 9	4 11	3 6
March.........	5 11	5 4	4 1	6 6	8 6	3 3	5 8	5 2	3 9
April..........	3 4	2 11	2 10	5 3	4 9	3 3	4 0	4 4	3 8
May...........	2 6	2 4	2 0	2 8	2 0	2 4	—	4 1	2 11

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

SEASON (1st July to 30th June).	EGGS.				HIDES (per lb.).		SKINS.		
	Johannesburg.		Cape Town, per 100.	Durban New Laid, per dozen.	Port Elizabeth.		Port Elizabeth.		
	New Laid, per dozen.	Fresh, per sozen.			1st Grade, Sun-dried.	1st Grade, Dry Salted.	Merino. Medium, per lb.	Merino. Combings, per lb.	Glovers, Sound, per skin.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938-39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940-41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941-42	1 6	1 4	10 7	1 9	7·2	7·3	5 ·1	8·6	4 0
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·5	9·7	3 4
1943—									
January	1 8	1 4	13 11	2 2	8·0	8·1	5·7	9·1	3 4
February	2 3	1 11	16 7	2 7	8·1	8·1	6·1	10·5	3 5
March	2 0	2 3	19 4	3 2	7·8	7·9	5·9	10 8	3 4
April	3 3	2 0	24 8	3 11	7·8	8·7	6·3	11·1	3 7
May	3 10	3 5	29 2	4 10	7·8	8·9	5·9	10·2	3 7

Average Prices of Potatoes and Onions on Municipal Markets.

SEASON (1st July to 30th June).	POTATOES (150 lb.).						ONIONS (120 lb.).		
	Johannesburg.				Cape Town.	Durban.	Johannesburg.	Johannesburg.	Cape Town.
	Transvaal. No. 1.	Transvaal. No. 2.	N.M. Grade 1. No. 2.	N.M. Grade 1. No. 3.	Cape No. 1.	Natal No. 1.	Transvaal.	Cape.	Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940-41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December	11 6	9 6	14 1	13 8	12 2	15 6	9 3	10 11	11 9
1943—									
January	7 9	6 8	10 9	10 8	10 9	14 2	8 5	9 4	7 8
February	8 3	7 2	11 8	11 6	8 4	13 7	7 10	10 9	7 8
March	8 10	8 5	13 1	12 7	8 4	13 9	8 1	11 0	7 3
April	11 5	11 1	15 8	15 0	13 0	14 7	11 6	12 10	9 10
May	12 6	12 2	15 11	15 5	15 6	16 3	16 4	15 8	13 2

Average Prices of Apples, Pears and Grapes on Municipal Markets.

SEASON (1st July to 30th June).	APPLES (Bushel box).						PEARS (Bushel box).		GRAPES (Tray).
	Johannesburg.			Cape Town.			Johannesburg.		Johannesburg.
	O'Henimuri.	White Winter Pearmain.	Wemmershoek.	O'Henimuri.	White Winter Pearmain.	Wemmershoek.	N.M. No. 1	Other.	Johannesburg.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	7 2	6 0	5 10	7 3	8 0	4 3	6 7	4 2	1 3
1940-41	8 4	7 1	6 4	8 11	10 8	5 7	8 11	6 3	1 8
1941-42	8 11	7 11	7 3	9 1	10 9	6 9	7 3	8 0	1 11
1942—									
January	—	—	—	—	—	—	—	7 5	3 2
February	8 3	—	12 2	8 10	—	—	7 3	7 8	1 6
March	7 5	6 11	7 6	7 7	9 3	6 3	5 6	7 0	1 10
April	8 6	7 6	6 8	7 9	9 8	6 2	—	9 6	1 11
May	8 10	7 7	6 5	8 9	9 7	5 6	—	8 11	2 0
June	10 1	8 10	8 4	8 7	10 9	6 3	—	15 9	2 5
July	11 2	11 4	8 1	10 10	12 1	8 11	—	—	0 10
August	17 6	15 8	10 6	11 7	11 8	9 10	—	—	—
September	16 4	16 3	7 0	11 11	11 3	—	—	—	—
October	16 6	16 3	—	9 11	9 4	—	—	—	—
November	20 8	18 6	—	10 4	7 2	—	—	—	—
December	19 7	17 8	—	11 10	17 5	—	—	14 10	3 8
1943—									
January	—	17 5	—	11 5	—	—	—	9 3	2 3
February	10 1	11 0	14 4	8 11	9 0	4 11	—	9 10	1 5
March	8 5	10 1	8 10	9 2	11 8	5 9	—	10 0	2 0
April	13 10	10 6	11 7	10 4	12 2	6 11	—	12 8	2 2
May	16 8	11 11	12 5	12 0	13 0	8 0	—	14 8	2 9

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

SEASON (1st July to 30th June).	GREEN BEANS (Pocket 20 lb.).			GREEN PEAS (Pocket 20 lb.).			CARROTS (Bag). (a)		
	Johannesburg.	Cape Town.	Durban.	Johannesburg.	Cape Town.	Durban.	Johannesburg.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 1
1940-41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	13 4
1941-42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 6
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	19 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 6	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 9	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	6 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10
1943—									
January	1 9	3 3	3 5	2 4	6 9	4 7	3 9	5 1	11 3
February	2 5	4 4	3 10	4 8	5 9	5 1	6 0	6 5	11 4
March	2 8	3 1	1 6	6 7	4 5	3 10	7 9	4 0	19 1
April	2 0	2 2	2 3	5 1	3 0	2 8	8 1	6 10	23 11
May	2 11	4 11	2 11	5 11	4 8	5 2	8 5	11 1	16 10

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

G.P.-S.1800—1943-4—200.

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Trellising of Vines.

E. M. Nyenhuis, Research Horticulturist, Vaal-Hartz Experiment Station.

TRELLISWORK for vines should be erected as soon as possible after planting has been completed. The system explained here is aimed at opening up the vines as much as possible and leaving the bunchs of fruit hanging freely below in the shade.

It is the system which is being adopted in many districts of the western Cape Province, when export grapes of high quality are produced, and is particularly suited to summer rainfall areas.

It facilitates the rapid drying off of all parts of the plants after a shower and so reduces the liability to disease attacks, and also permits of the ripening of the berries without undue exposure to the very hot sun or to hail.

This trelliswork must be erected directly over the vines and should run with the direction of the prevailing winds.

It consists of several strands of wire strained parallel, all three to four feet high above the ground over the vine rows. These strands of wire are kept apart by fixing crosspieces of wood horizontally on each standard so as to form a "T". Treated wooden poles with a diameter of at least 3 inches should be used as standards. They are planted 2 feet deep in the soil and 30 feet apart. Only the poles at the end of the rows should be of iron or of thicker wood. In loose soil it is advisable to place a fairly large flat stone at the bottom of each pole to serve as a solid foundation since the weight of a heavy crop may cause the poles to sink still further when the soil becomes very wet. The soil around the poles should also be firmly rammed, and care taken to have the poles in alignment, and standing at the same height. At the top end of each wooden pole a three-foot long piece of hardwood 2½ inches by 1½ inches thick is fitted horizontally and at right angles to the trellis row. It is fixed securely to the side of the wooden pole by cutting away a portion of the pole and securing both by means of a bolt 4 inches long and ⅜ inch thick with washers. This crosspiece should be fastened as firmly as possible.

On the top edges of the horizontal pieces, five strands of steel wire are stretched at equal distances apart, i.e., approximately 9 inches, and either fitted into shallow sawcuts or fastened loosely with staples until strained tight. The middle wire, usually No. 10 gauge, should run over the tops of the supporting standards, the other wires can be of No. 12 gauge.

On the thicker poles or the iron standards at the ends of the rows the wooden crosspiece must *not* be fixed *on to the standards*, but adjusted about two feet away from the pole. This prevents them from breaking in two under a heavy strain. Instead of sawing grooves into these end crosspieces, ¼ inch holes should be drilled approximately 9 inches apart, to accommodate the five wires.

Having the end crosspieces adjustable facilitates the straining of the wires at any future period, should it become necessary.

The ends of all five wires are tied to the top of each end-pole.

After the wires have been strained, each wire must be secured tightly to each crosspiece by tying with thinner wire or using staples.

 [*Continued on page 552.*

FARMING IN SOUTH ... AFRICA

Vol. 18 AUGUST 1943 No. 209

Editorial:

National Income and Income from Agriculture.

THE THIRD REPORT of the Commission for Industrial and Agricultural Requirements drew serious attention to the fact that in the year prior to the war, only 12·7 per cent. (£50 million) of the total net national income of the Union was derived from Farming, Forestry and Fisheries. The contributions by forestry and fisheries will be relatively insignificant. It can, therefore, be stated that about one-eighth of this country's national income (all races included) is derived from farming. In the same year the gold-mining industry alone contributed 18·4 per cent. to the net national income, and commerce and finance 16·2 per cent. Such calculations and comparisons are of the utmost importance for any purposeful system of social and political economy, and especially for a sound national agricultural policy. The fact is generally admitted that it is always more difficult accurately to assess in terms of money the income from the farming activities of a country than, for example, that derived from commerce, mining or manufacturing industries The first reliable calculations for this country (which were also used by the above Commission) were made two years ago by Messrs. S. J. J. de Swardt and A. J. du Plessis of the Division of Economics and Markets of the Department of Agriculture and Forestry. Being real pioneering work, these calculations can naturally be improved upon to approximate the actual figures more closely. In this issue of *Farming in South Africa* there appears an improved and carefully revised calculation by the same authors of the contributions of the combined agricultural activities of the Union (all races) to the collective net national income of this country, particularly during the years 1936-39, as well as an estimate of the incomes of European farmers and analyses of production and costs. Both the Division and the two research workers concerned are, however, fully alive to the fact, that these assessments can in no wise lay claim to infallible accuracy. The necessary data in respect of certain items are simply not available. Moreover, as every efficient farmer knows from experience, costs and yields in farming frequently cannot be calculated in terms of monetary accountancy value. It is, therefore, necessary in some cases for estimates and valuations to be made, even by qualified research workers who are authorities on our agriculture and have access to special sources of information. Even possible errors here or there (which would be almost inevitable) do not detract from the value and importance of the figures presented. Every experienced judge will admit that, on the whole, the figures display a large measure of realism and probability and the Division of Economics and Markets will welcome objective criticism and suggestions for improvement from such persons, who would thereby be rendering practical help towards making the calculations even more accurate and reliable. As the reader will observe for himself, Messrs. de Swardt and du Plessis were concerned only with the facts themselves. They neither give any judgement *pro* or *con*, nor do they offer any suggestions or recipes.

But their facts from an essential foundation, for searching questions from all thinking citizens of this country and for the practical task of the Statesmen, thus for example, one may ask whether the services rendered to the community by the farming population are relatively unimportant, or whether, owing to present economic conditions their reward is incommensurate with their services. It will, therefore, immediately be asked: Are the natural conditions in the country at fault, or does the fault lie with the industry and ability of our farmers? Or is it perhaps the existing social and economic structures which are at fault? Or is a re-adaptation and re-organization of our national agriculture itself indicated? Perhaps a more uniform distribution of the farming population in accordance with the natural conditions would be advisable. Perhaps a thorough reform of our marketing systems is necessary. All these (and many more) questions are evoked by the writers, even though they may merely have referred to them casually in the article and not posed them directly. The facts in themselves are, however, a sufficiently strong incentive to every man and woman who has the interests of this country and of its agriculture at heart, to give the matter serious thought.

(Dr. J. F. W. Grosskopf, Chief, Division of Economics and Markets.)

Nursery Quarantines.

The following nursery quarantines were in force on 1 July 1943:—

(1) Page's Nurseries, Franschhoek, C.P., on citrus (all), for red scale.

(2) Beaulieu Nurseries, Forestdale Siding, P.B. Grahamstown, C.P., on citrus (all), for red scale.

(3) Municipal Nursery, Randfontein, on palms (all), for circular purple, Ross and Spanish red scales.

Trellising of Vines:—

[Continued form page 550.

This tying prevents the wires from slipping to one side should sagging occur at any part and also relieves the strain on the end poles when the wires are supporting a heavy crop, since each upright pole is made to carry its share of the total weight.

It is essential that each end pole be strongly secured by two anchor wires, consisting of three strands of wire twisted together, one tied at the top and the other midway on the poles. These two anchor wires must be very strong and must be fastened to a firmly placed stone or concrete block buried three feet in the ground. They must also allow for any adjustment on replacement of the bottom half of the wire which may rust through at some future time.

A NEW BULLETIN FOR THE SHEEP FARMER.

Bulletin No. 236 "Cactus and Oldman-saltbush as Feed for Sheep" has recently been published. The Bulletin is obtainable from the Editor of Publications, Pretoria, at 6d. per copy.

A Medicine Chest for Stock Farmers in South Africa.

G. C. van Drimmelen, Government Veterinary Officer, Bloemfontein.

THE following article contains suggestions for the stocking of a medicine chest which should be of inestimable value to all stock-farmers in South Africa. Many stock farmers have had the experience of having to rush here and there, upon the outbreak of disease among their stock and frequently have had to spend hours at the telephone or on the road in order to obtain the remedy required for the treatment of the affected animals.

We feel convinced that with a well-stocked medicine chest such as that described below, considerable losses and unnecessary expense can be prevented, with beneficial results not only to the farmer, but indirectly also to the community as a whole. Preventive measures of this nature are imperative in view of the existing shortage of petrol and rubber, and the urgent problems of food production.

Examples.

The following are a few examples of prescriptions for the treatment of some of the commoner ailments and diseases:—

(a) For poor appetite.—Mix one (1) teaspoonful powdered *Nux vomica* two (2) tablespoonfuls ammonium carbonate, four (4) tablespoonfuls powdered ginger. Give *cattle* one (1) such mixed powder twice (2×) a day for six (6) days in succession by mixing it with their feed (bran) or by administering it on the back of the tongue.

Horses are given one-half (½) of this dose, and *sheep* one-eighth (⅛) of this dose. Animals sometimes refuse to take the mixture, in which case it can be mixed with syrup or molasses and applied by mouth.

(b) In cases of impaction of the fore-stomachs of ruminants.—Mix four (4) tablespoonfuls turpentine and one (1) pint liquid paraffin (medicinal paraffin) or one (1) pint raw linseed oil. Give as one (1) full dose to *cattle*, pouring the mixture very carefully into their mouths with the aid of a drenching bottle. *Sheep* should be given a quarter (¼) of this dose. A few hours later the mixture mentioned under (*c*) should be administered.

(c) In cases of paralysis of the fore-stomachs of ruminants.—Mix one (1) teaspoonful powdered *nux vomica* two (2) tablespoonfuls ammonium carbonate and one (1) cupful bicarbonate of soda. Give one (1) of these powders to cattle twice (2×) a day for six (6) days in succession, through the mouth (preferably mixed with syrup or mollasses).

(d) In case of colic in horses.—Prepare a solution of one (1) heaped tablespoonful chloral hydrate in one (1) cupful clean water and mix the solution with one (1) pint of raw linseed oil. Shake well and give as a drench with a stomach tube or very carefully with a drenching bottle by mouth. Colic may be due to various causes. The treatment prescribed here is very good in cases where it is due to irritation (inflammation, abnormal fermentation products, etc.), of the intestinal mucous membrane. If colic is caused by constipation, purgatives and especially also enemas *must* be applied. In the case of cattle and horses a bucketful (about 4 gallons) of lukewarm soapwater can be used as an enema.

(e) In case of bloating in ruminants.—Should the degree of bloating be dangerous use the stylet or trocar and cannula and after the gas has been expelled introduce the mixture of turpentine and raw linseed oil [as described under (*b*)] in the form of a drench through the cannula into the stomach.

(f) In case of constipation of the intestines.—Prepare a solution of one (1) pound Epsom salts and one (1) pound common salt, in one half (½) to one (1) gallon of water. When solution is complete, administer to *cattle* as a drench by mouth. Alternatively, administer with great care two (2) cups castor oil, or one (1) bottle raw linseed oil as a drench. Sheep are to be given one quarter (¼) of these doses. *Horses* should be given the same dose of the remedies mentioned for this purpose as cattle or the same quantities of turpentine and raw linseed oil as prescribed for cattle under (*b*).

(g) In case of diarrhoea.—Add to one (1) bottle of water, one (1) tablespoonful slaked lime, shake well several times and allow to settle. Now

prepare a mixture of one and a half ($1\frac{1}{2}$) cups raw linseed oil and one and a half ($1\frac{1}{2}$) cups limewater and shake well. Add two (2) heaped tablespoonfuls tanic acid powder and shake again. Carefully administer the full dose [i.e., about one (1) bottle full] to *cattle* by mouth twice (2×) a day. *Horses* should be given the same dose, but *sheep, goats* and *young calves* should get one third ($\frac{1}{3}$) of a dose.

(h) **Ophthalmia** (in case of all animals) can be treated by dropping a few drops of 5 per cent. Protargol- or Argyrol-solution in the affected eye several times a day. Pamphlets on diseases of the eye are obtainable from the Director of Veterinary Services, Onderstepoort.

(i) **Injuries and ophthalmia** (in case of all animals) can often be successfully treated with a mixture of one (1) part of sulphonamide powder (e.g. sulphadiazine) and nine parts of codliver oil. The mixture is dropped into the wound or eye after all dirt and superfluous secretions have been removed with clean swabs. In most cases the repeated use of disinfectants dissolved in water for the treatment of injuries is harmful except, of course, shortly after infection has been introduced from outside.

Injuries can often best be treated by spraying them very thoroughly at frequent intervals with blowfly spray.

Additional Information.

Information on the use of the other remedies mentioned in the list (Table 1) can be obtained by consulting veterinary surgeons and by reading the following pamphlets:—

"Poisonous Plants", by D. G. Steyn, *Farming in South Africa*, February, 1937. (Reprint 23/1937.)
"Geilsiekte in Sheep and Goats", by D. G. Steyn, *Farming in South Africa*, January, 1940. (Reprint 2/1940.)
"Lead Poisoning in Cattle", by D. G. Steyn, *Farming in South Africa*, September, 1940. (Reprint 63/1940.)
"Arsenical Poisoning in Stock", by D. G. Steyn, *Farming in South Africa*, August 1937. (Reprint 83/1937.)
"Internal Parasites of Horses", by H. O. Mönnig, *Farming in South Africa*, July 1943. (Reprint 7/1943.)
"Worms in Sheep", by H. O. Mönnig, *Farming in South Africa*, August 1940. (Reprint 58/1940.)
"Parasites of Fowls", by H. O. Mönnig and J. D. W. A. Coles, *Farming in South Africa*, January 1939. (Reprint 4/1939.)
"Internal Parasites of Cats and Dogs", by H. O. Mönnig, *Farming in South Africa*, August 1937. (Reprint 75/1937.)
"The Ascaris Worm of Pigs", by H. O. Mönnig, *Farming in South Africa*, January 1936. (Reprint 9/1936.)

And many others.

Warning.

Although the illustration is clear, we must issue this warning in capital letters:—

DO NOT KILL.

Too much medicine is worse than the disease itself. Rather give too little than too much.

NOTE:

(1) Label every bottle clearly with—
  (a) name of contents,
  (b) the dose for one of our domestic animals (state which animal).
(2) Keep poisonous substances in a special place, preferably keep them in blue bottles, mark and label the containers "POISON".
(3) Always lock the cupboard when not in use.

Dangerous Medicines.

The following is a list of medicines an excessive dose of which may easily prove fatal.

Medicine.	Dose for			
	Cattle.	Horses.	Sheep.	Other Animals.
Ammonium carbonate...	2 tablespoonfuls*	1 tablespoonful	1 dessertspoonful	—
Chloral hydrate........	4 tablespoonfuls	3 tablespoonfuls	—	—
Chlorodyne............	2 tablespoonfuls	2 tablespoonfuls	½ teaspoonful	—
Chenopodium oil.......	3 teaspoonfuls	2 teaspoonfuls	—	Pigs: 1 teaspoonful per 100 lb.
Castor oil.............	1 pint	1 pint	1 cup	—
Carbon bisulphide......	—	½-1 tablespoonful	—	—
Nux vomica (powdered)	1 teaspoonful	½ teaspoonful	—	—
Turpentine............	6 tablespoonfuls	4 tablespoonfuls	1 tablespoonful	—
Carbon tetrachloride....	—	1-2 tablespoonfuls	¼ teaspoonful = 1 c.c.	—

* The size of ordinary tablespoons, dessertspoons and teaspoons vary considerably, and every stock owner should therefore see that he has a set of "medicinal spoons" for his own use.

TABLE I.—*What to do when animals die.*

Suspected Cause of Death.	Requirements. (see numbers in Table III.)	Specimen.
Cattle always (and other animals when necessary)	3....................	Bloodsmears.
Suspected plant poisoning	3 and 50a and two sheets of blotting paper	Smear and organs in formalin, and suspected plant.
Suspected arsenical poisoning	5, and two canned-fruit bottles	Smear, also liver and stomach contents; 2 lb. of each in separate canned-fruit bottles.
Suspected prussic acid poisoning (geilsiekte)	3, canned-fruit bottle...	Smear and stomach contents in air-tight bottle.
Suspected anthrax. (Note: Dangerous to human beings, telephone Govt. Vet. officer or Magistrate)	3....................	Bloodsmear only, taken from ear; parcel to be marked—"ANTHRAX".
Suspected calf paratyphoid	3, 50a and 50b.........	Bloodsmear and pieces of liver, spleen and lung (thickness of a finger), in formalin and glycerin
Suspected black quarter..	3, and a canned-fruit bottle	Bloodsmear, smear of muscle, and piece of affected muscle in twice the quantity of salt.
Suspected swine plague..	3 and 50b............	Bloodsmear and lymphatic glands in glycerine.
Suspected heart water....	3 and 50a............	Bloodsmear and half of brain in formalin.
Suspected rabies. (Note: Dangerous to human beings; telephone district surgeon, Govt. vet. officer or magistrate	3, 50a and 50b........	(Only when no vet. officer or medical officer is available) bloodsmear and head of animal in tin or bottle, marked "RABIES".
Suspected east coast fever: Telephone govt. vet. officer or magistrate.	3....................	Bloodsmear and smear of gland or spleen.

This table can be posted up near the supply of slides for consultation in case of deaths Particulars and specimens can be sent to the local Government Veterinary Officer or to the Directory of Veterinary Services, Onderstepoort.


Bicarbonate of Soda
Koeksoda
Aniseed powder
Anys poeier
Flowers of Sulphur
Blomswael
Epsom Salt
Ammonium Karbonaat
Ammonium Carbonate
Raw Linseed oil
Liquid Paraffin
Parafienolie
Ongebluste Kalk
Unslaked Lime
Tetrol
Tincture of Iodine
Gips
Tripaan
Kleef-pleister
Sticking plaster
Karbolliese Ontsmettingsvloeistof
Chemical Cattle dip
VASELIEN
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TABLE II.—*Diseases and their Remedies.*

Affections.	Instruments.	Remedies.
Poor appetite	—	15, 17, 18
Constipation	8, 10	12, 13, 21, 22, 23
Colic	8, 10	30
Hoven, bloating	8, 9, 10	21, 22, 28
Diarrhoea	8, 10	19, 21, 22, 33
Arsenical poisoning	2, 8, 10	31
Prussic acid poisoning	2, 8, 10	20, 31
Ophthalmia	—	27, 42, 43.
Mastitis	—	26
Anthrax (prevention)	2	38
Calf paratyphoid (prevention)	2	39
Red water	2, 11	44
Biliary fever	2, 11	44
Worms	1	34, 35, 36
Stiff joints	54	26, 49
Fractures	52, 54	32
Abscesses	5	27, 40, 42, 43
Wounds	51, 52, 53, 54	27, 40, 42, 43, 46
Fleas	—	45, 48
Lice	—	45, 48
Ticks	—	47

TABLE III.—*Contents of the Medicine Chest.*

No.	*Item.*
1.	Dosing syringe, 2 oz., with nozzle.
2.	Hypodermic syringe with needle and needle-holder.
3.	Slides for bloodsmears and organ smears.
4.	Notebook for dates, prices and new prescriptions.
5.	Abscess knife.
6.	Post mortem scissors.
7.	Post mortem knife and steel.
8.	Stomach tube for safe dosage of cattle, horses and pigs (enema-tube).
9.	Trocar and cannula (large and small) for treatment of bloating (with mallet).
10.	Metal dosing bottle.
11.	Funnel and tube for intravenous injections and for enema treatment in small animals.
12.	Common salt.
13.	Epsom salts.
14.	Bicarbonate of soda.
15.	Ammonium carbonate.
16.	Aniseed powder.
17.	Ginger powder.
18.	Nux vomica powder.
19.	Tannic acid.
[illegible]	Flower of sulphur.
[illegible]	[illegible]aw linseed oil.
22.	[illegible]uid paraffin.
23.	[illegible] oil.
24.	Bul[illegible]um oil.
25.	Ca[illegible] [illegible]phide.

No.	*Item.*
26.	Camphorated oil.
27.	Cod liver oil.
28.	Oil of turpentine.
29.	Chlorodyne.
30.	Chloral hydrate.
31.	Sodium hyposulphate.
32.	Plaster of Paris.
33.	Unslaked lime.
34.	Copper sulphate.
35.	Nodular worm remedy.
36.	Tetrol.
37.	Blowfly spray.
38.	Anthrax vaccine.
39.	Calf paratyphoid vaccine.
40.	Tincture of iodine.
41.	B.I.P.P.
42.	Sulphadiazine.
43.	Protargol, 5 per cent. solution.
44.	Trypan blue.
45.	Carbolic disinfectant.
46.	Non-poisonous disinfectant.
47.	Arsenical cattle dip.
48.	Insect powder.
49.	Vaseline.
50.	Specimen bottles.
50A.	10 per cent. formalin.
50B.	50 per cent. glycerine.
51.	Sterile bandages for open wounds.
52.	Cotton (absorbent).
53.	Sticking plaster.
54.	Stable bandages for protective purposes.

Edito

Contribution of Agriculture to the National Income of the Union.

S. J. J. de Swardt and A. J. du Plessis, Division of Economics and Markets.

A CAREFUL calculation of the annual net national income of the Union of South Africa extending over a number of years was undertaken for the first time a few years ago by the Department of Economics of the Witwatersrand University under the guidance of Prof. S. H. Frankel. The findings of that investigation were published in the third report of the Industrial and Agricultural Requirements Commission (1941), but the portion dealing with the net income from the agricultural industry was done by the Division of Economics and Markets of the Department of Agriculture and Forestry. The object of this article is to discuss in greater detail the calculation made in respect of agriculture.

Preliminary data in this connection have already been published in the July 1941, issue of "*Crops and Markets*" (also see the issue of August 1941). These preliminary figures, as well as those contained in the report of the abovementioned Commission, have since been somewhat amended, however, in the light of further and better information, which has become available. The data given in this article will therefore not always correspond with those previously published. Indeed, the figures given here must by no means be taken as absolutely final and correct. Many of them are admittedly based on expert estimates which, however, are in some cases based on scanty information. These estimates can always be improved upon when fuller information becomes available. Any suggestions from readers in this connection will therefore be welcomed. Nevertheless, the estimates contained in this report are the best that can be made at this stage. In view, therefore, of the general scantiness of figures in connection with the income derived from agriculture, it is felt that these estimates and the explanation of the method used in obtaining them will meet a serious want among social thinkers.

Method of Calculating the Net Income from Agriculture.

The contribution of agriculture to the total national income, i.e., the net agricultural income, has been calculated by deducting from the gross value of all agricultural production (excluding stock feed and seed) the total costs (excluding interest on bonds, rent for land and cash labour costs) incurred in effecting this production. What remains, is the total net contribution of agriculture to the national income. This calculation has been made for every year from 1924-25 to 1939-40. To save space, however, only the details of the average gross value of every kind of product, for the period 1936-37–1938-39 are given here, while the details of the separate items of expenditure are also given only for the period 1936-39. For the annual figures only the totals are therefore indicated. All the calculations are available, however, and if any serious investigators require full particulars in connection with any product or item of expenditure, they may obtain them from the Division of Economics and Markets, Union Buildings, Pretoria.

It should be noted that where mention is made of income from "agriculture" in the present report, this refers to "the agricultural industry of the Union as a whole", i.e., the combined agricultural production *of all races*. This includes the value on the farm of

products consumed by all races concerned in the production of agricultural products. The latter also includes the value of products like vegetables, fruit, eggs and milk, produced by persons living in urban and semi-urban areas. Later in this article a calculation is made of the net income of European farmers alone, i.e., those indicated by the agricultural census as "European farmers". This figure is, however, by no means the same as that for the net income from agriculture. It should also be pointed out that although the figures, as published in the report of the Industrial and Agricultural Requirements Commission include the value of forest and fishery products, this is not the case as regards calculations given in this article. Here only the value of farm products have been taken into consideration. The estimated value of forest and fishery products are given in Table 1 merely for the sake of completeness and to indicate their relative importance.

(1) Gross Value of Agricultural Production.

The average annual value of these products for the three years 1936-37–1938-39 is indicated in Table 1 below. This represents the value of the products on the farm, i.e., it is estimated on the basis of market prices, minus all marketing costs and railage, and includes all subsidies and allowances paid to farmers by the Government or marketing boards, as well as any supplementary payments made to them. It includes the value of quantities sold, as well as of that consumed on farms and in native reserves. To obviate double calculations, however, quantities used for stock feed, e.g., all hay, the greater part of the production of oats, rye and barley, and part of the maize crop, are not included, since the value of the feed is reflected in the value of animal products; quantities retained for seed have also ben excluded. The calculations are therefore based on the prices realized for the different products on the most important markets and received by farmers, plus all subsidies, allowances and supplementary payments, but minus marketing costs and railage. They are also based on production figures as obtained from different sources, e.g., the Agricultural and Industrial Censuses, the annual reports on "*Trade and Shipping*" (of the Commissioner of Customs and Excise), the *Official Yearbook*, etc., except in the case of vegetables, fruit, milk for drinking purposes, poultry and poultry products. In the case of milk for drinking purposes, vegetables and fruit, production has been calculated according to the estimated average consumption, per capita for each of these products. In the case of fruit, the value of the quantities exported is also included. In the case of poultry products, the production of eggs is calculated on an estimated average yield per hen per year. (The value of forest products have been calculated in consultation with the Division of Forestry, while the estimate for fishing products has been made by the Director of Fisheries.)

(2) Cash Expenditure on Agricultural Production.

The calculation of the average annual cash expenditure (excluding cash spent on labour costs, rent for land and interest on bonds) incurred by producers (European and non-European) during the period 1936-39 is given in Table 2.

In calculating the contribution of agriculture to the national income, expenditure in connection with labour has not been included as a cost, since in the great majority of cases the money is paid to labourers who are directly dependent on agriculture for their living. Payment for services rendered by skilled workmen, etc., in the towns,

has, however, also been included in the costs. Expenditure on rent for land and interest on loans is not allowed as costs, since in making such calculations the view is generally taken that these payments must be made out of the net income. Furthermore, the rent or value of land varies according to the profitability of production.

TABLE 1.—*Calculation of the Annual Gross Income from Agriculture.* (Average 1936-37–1938-39.)

Maize	£9,247,000		
Wheat	3,724,000		
Kaffercorn	677,000		
(1) Other winter cereals	120,000		
TOTAL CEREALS		£13,768,000	
Potatoes	707,000		
Sweet potatoes	151,000		
Other vegetables	2,928,000		
TOTAL VEGETABLES		3,786,000	
Sugar cane		3,449,000	
Fruit (all kinds excluding fresh grapes)		4,975,000	
(2) Viticultural products (including fresh grapes)		1,817,000	
Wattle bark and extract		853,000	
Tobacco		776,000	
Dried beans and peas	194,000		
Groundnuts	124,000		
Chicory root	36,000		
Cotton	17,000		
Other minor field-husbandry products	100,000		
TOTAL MINOR FIELD-HUSBANDRY PRODUCTS		471,000	
TOTAL FIELD-HUSBANDRY PRODUCTS			£29,895,000
Wool		9,802,000	
Slaughter cattle	5,597,000		
Slaughter sheep, goats and lambs	4,132,000		
Slaughter pigs	1,351,000		
TOTAL SLAUGHTER STOCK		11,080,000	
Poultry and poultry products		2,237 000	
Fresh milk	4,398,000		
(3) Other dairy products	2,600,000		
TOTAL DAIRY PRODUCTS		6,998,000	
Mohair	365,000		
(4) Hides and skins	172,000		
Ostrich feathers	29,000		
Other minor animal-husbandry products	100,000		
TOTAL MINOR ANIMAL-HUSBANDRY PRODUCTS		666,000	
TOTAL STOCK-BREEDING PRODUCTS			£30,783,000
TOTAL AGRICULTURAL AND STOCK BREEDING PRODUCTS			£60,678,000
(5) Forest products		670,000	
(6) Fishery products		1,600,000	
TOTAL FORESTRY AND FISHERIES			2,270,000
GRAND TOTAL FARMING, FORESTRY AND FISHERIES			£62,948,000

(1) Barley, rye and oats.

(2) Includes wine. distilling wine, fresh grapes, raisins and sultanas.

(3) Butter, cheese, ice cream and condensing milk and skimmed milk for human consumption—prepared in consultation with the Division of Dairying.

(4) Does not include hides and skins of animals killed as slaughter stock, as this has already been included in the value of slaughter stock.

(5) Prepared in consultation with the Forestry Division.

(6) Prepared by the Director of Fisheries.

TABLE 2.—*Calculation of the annual cash expenditure incurred by Agricultural producers for production purposes during the four years* 1936 *to* 1939.

1. (*a*)	Agricultural machinery, implements and spare parts, including paid services for repairs	£2,963,000
2. (*b*)	Expenditure in connection with motor cars (used only for farm work)	1,763,000
3. (*b*)	Expenses in connection with lorries and motor trucks	982,000
4. (*a*)	Wagons, cars, scotch carts, wheelbarrows, trek gear and horseshoes, plus paid services for repairs	371,000
5. (*a*)	Windmills	156,000
6. (*a*)	Engines, pumps, pipes and tanks	590,000
7. (*c*)	Irrigation fees	124,000
8. (*d*)	Drilling expenses	143,000
9. (*a*)	Fertilizers (incl. bonemeal for fertilizer)	1,548,000
10. (*a*)	Oil-cake meal, salt, blood, meat and fish-meal, bran, pollard and bonemeal for cattle feed	611,000
11. (*e*)	Bags, pockets, wool packs, binder twine and twine	842,000
12. (*a*)	Fuel	993,000
13. (*a*)	Packing material	578,000
14. (*a*)	Dips and sprays	357,000
15. (*a*)	Fencing material	788,000
16. (*f*)	Building material, incl. paid services	550,000
17. (*f*)	Hired transport	800,000
18. (*g*)	Fees and expenses on transfer of property	525,000
19. (*f*)	Medicines, vaccines, veterinary services, etc.	400,000
20. (*f*)	Milling costs of farm feeds	200,000
21. (*f*)	Taxes	100,000
22. (*f*)	Telephone costs	144,000
23. (*f*)	Insurance premiums	150,000
24. (*a*)	Imported seed	80,000
25. (*f*)	Periodicals, stationery, stamps, advertisements, etc.	50,000
26. (*f*)	Miscellaneous	600,000
	TOTAL CASH EXPENDITURE	£16,408,000

(*a*) Calculated from average annual imports, plus local production at prices delivered to farmer at nearest railway station, i.e. at retail prices including railage. Costs in connection with paid services for repairs to machinery, implements, waggons, carts, etc., have, however, been calculated from data obtained in the course of cost of production studies and agro-economic surveys. Fuel does not include petrol used by motor cars, lorries and motor trucks.

(*b*) Calculated at 2,000 miles per annum per motor car and 4,000 miles per annum per lorry used for farming operations at 4·5d. per mile for cars and 7·65d. per mile for lorries. Number of cars and lorries based on information supplied in Agricultural Census for 1936–37. These costs per mile cover all expenditure in this connection, viz; petrol, oil, tyres and tubes, repairs, spare parts and new purchases.

(*c*) Calculated at 10s. per morgen taxed irrigable ground.

(*d*) Calculated from data supplied in the Annual Report of the Director of Irrigation.

(*e*) Wool packs, binder twine and twine calculated from annual imports at cost delivered to farmer, including railage. Grain bags calculated according to average annual size of crops of the most important cereals, e.g. maize and wheat with an allowance for the use of second-hand bags. The value of annual requirements of pockets has been arbitrarily fixed.

(*f*) Calculated from data obtained from cost of production studies and agro-economic surveys

(*g*) Calculated from data showing the value of agricultural properties transferred annually and as published by the Office of Census and Statistics.

The value of purchased requirements has in most cases been calculated on the basis of the average annual imports and the local production of these articles, as indicated in the annual reports of *Trade and Shipping* of the Customs Commissioner and the Industrial Censuses. These purchases are then further calculated at delivered costs to the farmer, i.e., at the average retail price plus an estimated amount for railage. In cases where the articles imported were not all used for agricultural purposes, only the value of that part which must be debited to agriculture was taken.

Some costs have, however, been calculated with the assistance of data and information collected in the course of studies in production costs, and the agro-economic surveys undertaken by this Division during the years 1936-41. Detailed first-hand data and information in connection with all costs per farm were collected in the particular areas where the surveys were made. They therefore, provided a valuable basis for the calculation of some of these items of expenditure.

Where insurance premiums are shown as costs, it should be pointed out that neither life-insurances nor co-operative agricultural insurance are included, since the latter cannot be regarded as costs incurred in connection with agricultural production. Taxes, too, do not include either personal and income tax or motor and lorry licences, etc., since the latter items have been included under costs connected with motors and lorries. For further details on the calculation of motor and lorry costs, see the foot-note to table 2. "Hired transport" refers to road transport and not to railway transport, since the latter is in any case included in the cost of purchased requirements.

No separate calculation is made for threshing costs, since threshing machines, tractors and steam engines are included with the total costs of agricultural machinery, implements, tractors, engines and fuel, and because most of the owners of threshing machines are farmers.

(3) Net Value of Agricultural Production.

According to Table 1, the gross value of the total agricultural production for the three years 1936-37 to 1938-39 averaged £60,678,000 per year, i.e., without the value of forest and fishery products. From Table 2 it appears that the average annual cash expenditure (excluding labour costs, rent for land and interest on bonds) for the period 1936-39 which was incurred to obtain the above productions, was estimated at £16,408,000. This leaves an average net value of £44,270,000 per year for agricultural production, an amount which consequently represents the average annual net contribution of agriculture (excluding forestry and fisheries) to the total net national income of the Union as a whole during the years 1936-1939.

Annual Contribution of Agriculture to the Total National Income.

The annual *gross income from agriculture* since the year 1924-1925 is given in Table 3 (first column).

Secondly, the calculated *total annual cash expenditure* (excluding that on forestry and fishery) is indicated. Since it is impossible owing to the lack of the necessary information and data, to calculate each one of the items of expenditure (as indicated in Table 2) annually from 1924-28 in the *same* way as for the four years 1936-39 (Table 2), these have been calculated in the following way:—

(*a*) The total cash expenditure in connection with fertilizers, fencing materials, implements and machinery, bags, woolpacks, other hessian pockets, binder twine, twine, sprays, dips and packing materials, which it is possible to determine annually, has been carefully calculated for each of the years 1924-40. (*b*) Since the expenditure on these articles is very respresentative of the total cash expenditure under review, the latter has been calculated for all the years 1924-40 on the basis of the relation of that mentioned in (*a*) to the total cash expenditure during the basic period 1936-39 (indicated in table 2).

By subtracting the cash expenditure (column 2 of table 3) from the annual gross income from agriculture, *the annual net income from agriculture* is obtained, or, in other words, the *annual contribution of agriculture to the total naltional income*: This is indicated in column 3 of the table.

TABLE 3.—*Annual Gross Value of Agricultural production (excluding Forestry and Fisheries), total cash expenditure; net value of agricultural production and total national income of the Union of South Africa.*

	(*a*) Gross Value of Production.	(*b*) Total Expenditure for Production. Purposes.	(*c*) Net Income from Agriculture.	(*d*) Net National Income of Union	Percentage Net Agriculture to Total for Union.
	'000. £	'000. £	'000. £	'000. £	
1924–25..........	58,785	14,439	44,346	227,000	19·4
1925–26..........	50,926	14,767	36,159	233,000	15·5
1926–27..........	56,190	14,111	42,079	247,000	17·0
1927–28..........	62,940	14,439	48,501	269,000	18·2
1928–29..........	59,712	17,721	41,991	264,000	15·9
1929–30..........	49,683	19,526	30,157	247,000	12·1
1930–31..........	40,663	12,798	27,865	232,000	12·1
1931–32..........	36,697	9,517	27,180	216,000	12·5
1932–33..........	35,588	6,399	29,189	235,000	12·3
1933–34..........	52,879	8,532	44,347	280,000	15·7
1934–35..........	48,312	12,798	35,514	294,000	12·2
1935–36..........	52,265	13,619	38,646	325,000	12·0
1936–37..........	61,662	14,767	46,895	366,000	12·8
1937–38..........	57,042	17,064	39,978	368,000	10·9
1938–39..........	63,327	16,572	46,755	391,000	12·0
1939–40..........	68,327	17,228	51,099	434,000	11·8

(*a*) The gross value of agriculture does not include that of forestry and fisheries.

(*b*) The annual cash expenditure has been calculated as follows:—

The average annual cash expenditure for 1936–37, as given in Table 2, has been taken as a basis and the corresponding amounts for each of the other years then calculated from this according to an index. The index is arrived at from the *value* of the annual purchases of implements and spare parts, fencing material, bags, wool packs, pockets, binder twine and twine, fertilizers, sprays, dips and packing material. This has been calculated from the annual imports plus local production at cost delivered to the farmer at the nearest railway station. The index is as follows (basis 1936–39 = 100):—

1924–25...... 88	1925–26...... 90	1926–27...... 86
1927–28...... 88	1928–29......108	1929–30......119
1930–31...... 78	1931–32...... 58	1932–33...... 39
1933–34...... 52	1934–35...... 78	1935–36...... 83
1936–37...... 90	1937–38......104	1938–39......101

This method of calculating cash expenditure differs from that used by Prof. Franke of the Witwatersrand University. Prof. Frankel calculated the annual cash expenditure on a percentage basis of the annual gross value of agricultural production.

(*c*) Calculated by subtracting the annual cash expenditure (column 2) from the annual gross value of agricultural production (column 1).

The net income from agriculture differs somewhat from that given in the third preliminary report of the Industrial and Agricultural Requirements Commission (1941), because the figures for agriculture have since been revised and amendments made, and especially also because the value of forestry and fisheries have not been included here.

(*d*) As calculated by Prof. S. H. Frankel of the Witwatersrand University and published in the third preliminary report of the Industrial and Agricultural Requirements Commission (1941), but amended according to the changed net income figures for Agriculture, and the value of forestry and fisheries excluded from agriculture, but included in the net national income of the Union as a whole.

The 1939–40 calculations were not published in the abovementioned report, but do appear in the March, 1943, issue of "The South African Journal of Economics".

In the other two columns of this table the *total national income* for the country as a whole, and the percentage which agriculture forms of this total are also indicated.

Table 3 therefore indicates the following in particular:—

(i) The gross value of agricultural production declined from the peak level of £62,940,000 in 1927-28 to the low-water mark of £35,588,000, in 1932-33, after which it gradually rose to £68,327,000 in 1939-40.

(ii) The cash expenditure for agricultural production purposes declined from the peak level of £19,526,000 in 1929-30 to a low-water mark of about £6,400,000 in 1932-33, after which it gradually rose again. This considerable drop in the cash expenditure during the years of depression is due not so much to a decline in the prices of agricultural requirements, as to a shrinkage of purchases.

Table 4 indicates the percentage contributed annually by agriculture and a few of the other important branches of the South African national economy to the total income.

TABLE 4.—*The percentage contribution of some of the main groups to the total national income.*

	Agriculture.	Factories.	Mining.	Commerce and Finance.
1924–25	19·4	12·3	17·6	18·1
1925–26	15·5	13·3	18·5	18·5
1926–27	17·0	13·4	18·2	18·2
1927–28	18·2	13·0	18·6	17·8
1928–29	15·9	14·4	17·0	19·3
1929–30	12·1	15·8	17·8	17·4
1930–31	12·1	15·9	16·8	16·4
1931–32	12·5	15·7	18·1	14·4
1932–33	12·3	13·2	23·8	14·5
1933–34	15·7	13·6	20·8	16·8
1934–35	12·2	15·7	21·4	17·3
1935–36	12·0	16·3	20·6	17·5
1936–37	12·8	16·7	19·7	18·3
1937–38	10·9	17·9	19·8	17·1
1938–39	12·0	17·9	20·7	16·4
1939–40	11·8	17·5	22·6	16·6

N.B.—These percentages are based on the calculations made by Prof. S. H. Frankel of the Witwatersrand University, but include amendments according to the changed net income figures for agriculture. The value of forestry and fisheries is excluded from agriculture, but included in the net national income for the Union as a whole.

A point worth noting in this table is the fact that during the period under discussion the importance of agriculture declined in relation to the total net national income. Whereas the net contribution of agriculture amounted to approximately 19 per cent. of the total in 1924-25, this was only 12 per cent. in 1939-40. This decline is not due to an actual decrease in the net national income from agriculture, which really increased during this period, but to an increase in the income from certain other groups, the most important of which are the manufacturing and gold-mining industries.

Alarming Conclusion.

It is, however, an alarming fact to discover that since 1934 the contribution of all branches of South African Agriculture to the total national income of the Union including the production of all Natives and Coloureds, as well as the food production in and around

the cities and towns, of persons who are not really agriculturalists has never exceeded 13 per cent. of the total, as is indicated in Table 4. These figures are the more alarming when it is borne in mind that this income averaging approximately 12 per cent. of the total, virtually represents the income of approximately 696,000 Europeans and nearly 6 million non-Europeans, i.e., of about 70 per cent. of the population of the Union.

Space does not here permit of a detailed discussion, together with the necessary calculations, of the trifling income derived by farmers from other sources or of the wages earned by rural natives from the reserves on the mines and in the towns, or of allowances in respect of unmeasurable remunerations for those living in rural areas; but it can be said that in spite of any adjustments which may accordingly be made, the fact remains that about 35 per cent. of the European section of the population and about 77 per cent. of the non-European section received less than 13 per cent. of the national income in the pre-war years.

This finding confronts us with one of the most important social problems in South Africa, namely:—

To what extent is this small share due to:

(a) inefficient methods of agricultural production;
(b) a relative maldistribution of the population; and
(c) a maldistribution of the national income?

Anyone with an intimate knowledge of agricultural conditions, farming methods and the geographical distribution of our population, will readily admit that there is much which still has to be done and can be done to improve agricultural methods in this country, and that certain parts, despite an improvement in these methods, cannot possibly provide a reasonable income for their present population. After due allowance has been made for all this, we still cannot help feeling that, with prices as they were in 1939, the agricultural section of the population received an income which was definitely very low in comparison with that of most of the other income groups.

It is against this background of a declining share in the national income (and its causes) that the measures applied since 1933 for the improvement of the economic position of agricultural producers, should be judged. The most important of these measures were those in connection with marketing matters.

Consequently, the presence of this large and poor rural population and the comparatively small income which it derives from agriculture, must be borne in mind as one of the basic facts in drawing up a scheme for social reform after the war, because there is no doubt whatever that the prices for agricultural products in South Africa are bound to fall considerably after the war and that the net income from agriculture is also bound to drop in comparison with the present (1943) income, especially if timely steps are not taken to ensure a balanced state of affairs.

Volume of Agricultural Production.

The varying value of agricultural production alone does not by any means indicate whether the total production has increased or decreased during a certain period, since the value naturally also depends on the prevailing prices during the period concerned.

In order to provide a better indication of the annual volume, i.e., the actual amount of agricultural production in respect of Europeans and non-Europeans, comparable index figures have been compiled for the years 1923-24 to 1939-40, viz., on the basis of the

annual production of each product, correlated with a constant price. (In these cases the average price of each product for the years 1936-37–1938-39.)

These data were then further summarized in order to give a clearer picture of the position. In Table 5 the average volume of production during the three periods 1923-24 to 1928-29, 1929-30 to 1934-35 and 1935-36 to 1939-40 is expressed as a percentage of the average for the first-mentioned period (viz., from 1923-24 to 1928-29 fixed at 100). For purposes of comparison the average value of production for the same three periods has also been expressed as a percentage of the first-mentioned period.

The three periods may be considered respectively as: the pre-depression period, the depression period and the post-depression period, and as each of these periods is comparatively long, it may be assumed that the effect of very poor years or of comparatively prosperous years has been largely eliminated.

TABLE 5.—*Average annual percentage increase or decrease of (a) the volume and (b) the value of Agricultural production (European and non-European) for various periods.*

Volume.	Pastoral Products.	Slaughter stock.	Dairy Products.	Other Animal-husbandry Products.	Total Animal Husbandry Products.	Cereals.	Vegetables, Fruit and Viticulture Products.	Other Field-husbandry Dry Products.	Total Field-husbandry Dry Products.	Total Agricultural Products.
1923-24 to 1928-29........	100	100	100	100	100	100	100	100	100	100
1929-30 to 1934-35........	121	106	241	117	119	115	140	124	123	121
1935-36 to 1939-40........	104	121	396	129	129	145	187	165	159	141
Value.										
1923-24 to 1928-29........	100	100	100	100	100	100	100	100	100	100
1929-30 to 1934-35........	52	99	105	119	85	77	112	96	91	87
1935-36 to 1939-40........	68	147	158	159	116	113	148	150	130	121

N.B.—In the case of cereals and other field husbandry products it should be borne in mind that the value of seed and of the portion used as stock feed is not included.

The table reflects, *inter alia*, the following:—

(*a*) The greatest increase in the volume of production occurred in the case of dairy products, viz., 296 per cent. from the period 1923-24–1928-29 to the period 1935-36–1939-40, whereas the value over the same period increased by only 58 per cent.

(*b*) Pastoral products were the only group which did not show a general increase in volume. After an average increase of 21 per cent. between the first and second periods, there was a decrease again during the third period, due to a considerable decline in the production of wool (the principal product in this group) during the next few years as a result of the drought experienced in 1933-34. This is also the only group showing a decrease in value.

(*c*) The total crop production increased in volume by 59 per cent., while the total animal-husbandry production increased by only 29 per cent.

(*d*) The production of "other field-husbandry crops" increased in volume by 65 per cent., mainly as the result of an expansion in the production of sugar cane, wattle bark and tobacco.

(*e*) The production of cereals increased in volume by 15 per cent. as the result of an increase in the production of wheat, while the value of cereal production increased by only 13 per cent.

(*f*) Of outstanding importance is the fact that the total agricultural production showed an increase in volume of 21 per cent. from the first period to the second, while the *value* over the same period showed a decrease of 13 per cent., and from the first to the third periods the *volume* increased by 41 per cent., but the *value* by only 21 per cent.

(*g*) It is also of special interest to note that in all groups the increase in the *volume* of production was considerably greater than the increase in the *value* of production, except, however, in the case of the groups " slaughter stock " and " other animal-husbandry products ". In these two groups the increase in the value of production was greater than the increase in the physical amount, i.e., only in the case of these two groups was the average price in the third period better than that during the first period of comparison.

The Income of European Farmers.

As the greater part of the agricultural industry in South Africa is controlled by Europeans, it is only natural to ask: which " contributions of agriculture to the national income " can really be considered as the income of Europeans? It is practically impossible to make any accurate distribution of income with the existing statistical material at our disposal. It is, for instance, not definitely known how many farm labourers, European and non-European, there are; nor do the agricultural censuses differentiate between European and coloured farmers.

Figures are, however, available from which the average annual net income derived from agriculture could be estimated for the period 1936-39 in respect of the approximately 100,000 farmers indicated in the agricultural censuses as " European farmers ", i.e., owners, lessees, share croppers and even " bywoners ". This includes everybody on holdings one morgen or more in extent. It should be pointed out, furthermore, that under " European farmers " as enumerated by the agricultural censuses, a number of coloureds and Asiatics managing holdings larger than one morgen are also included. A point to note particularly, is that the calculated income of this group of " European farmers " or farm managers is not altogether comparable with the group-income figure for *agriculture as a whole*, because the latter also includes the incomes of labourers and foremen, whereas the former represents the incomes of " European farmers " or farm managers, after the wages of labourers and foremen have been deducted. The results of the estimate are, however, given here because when the preliminary figures were published in July and August, 1941, it appeared that the public would like to gain some idea of the amount of the net income of the European farming population, in order to be able to compare this with the agricultural income figure as a whole, although the two figures cannot really be compared on the same basis.

Gross Income of " European farmers."—The following deductions must be made from the gross income derived from agriculture as a whole (excluding forestry and fisheries) as shown in Table 1 for the years 1936-37 to 1938-39:—

(1) The value of production by natives; and

(2) The value of production by those persons who are not farmers, but who do produce on plots in towns and villages. This includes

mainly vegetables, milk and eggs. In this way the gross income of farmers, excluding native farmers, is obtained.

Cash Expenditure of "European Farmers" on Agrictultural Production.

Now, in order to determine the cash expenditure of "European Farmers" on agricultural production, the costs incurred in connection with native production have been deducted from the estimated expenditure given in Table 2. Thus it was estimated that the costs incurred by farmers only, averaged approximately £15,608,000.

On the basis of information collected during the various cost of production studies conducted in different parts of the country, and on the basis of the number of agricultural workers enumerated by the agricultural census, a calculation has also been made of the average annual cash disbursements to non-European labourers employed by European farmers. The figure amounted to approximately £9,600,000, while the value of rations produced on the farms of Europeans, together with the value of rations which had to be purchased and were consumed by non-Europen labourers as part of their wages, is estimated at approximately £4,800,000.* Similarly, cash wages to European labourers was estimated at £2,400,00 and their food at £800,000.

The agricultural income of European farmers was then calculated as follows:—

ESTIMATE OF NET INCOME OF "EUROPEAN FARMERS" (ANNUAL AVERAGE PERIOD 1936/37—1938/39).

	£	£
Value of total agricultural production		60,678,000
Value of Native production	8,477,000	
Value of production on holdings less than 1 morgen in extent	1,136,000	9,613,000
Value of production by "European farmers"		51,065,000
Miscellaneous cash expenditure (excluding labour) on agricultural production (table 2)		16,408,000
Cash expenditure on native production		800,000
Miscellaneous cash expenditure on production by "European Farmers"		15,608,000
Wages:—		
Non-European labourers	9,600,000	
Food for non-European labourers	4,800,000	
Cash to European foremen and labourers	2,400,000	
Food for European foremen and labourers	800,000	17,600,000
Running expenses of "European Farmers"		33,208,000
Net farm income of "European Farmers"		17,857,000

*N.B.—Farm-produced as well as purchased rations have been included as the latter item also amounts to a cash expenditure. Milk for drinking purposes is included with other animal husbandry products and not with dairy products.

From the above calculation it will, therefore, be seen that after the necessary adjustments have been made for the income and expediture in connection with persons who are not regarded as "European farmers", the net income of the farming industry amounts to approximately £17,857,000 per annum for "European farmers" or farm managers during the period 1936-39.

This amount does not, however, represent the amount which farmers have left for themselves and their families, because no provision has been made yet for interest on borrowed capital and for redemption of debts.

According to an unpublished estimate by the writers, the burden of debt on mortgaged agricultural land during the abovementioned period was about £73,000,000. Interest on this sum at 5 per cent. amounts to £3,650,000, less an interest subsidy of approximately

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Loss of Weight in Broody Hens.

P. J. Serfontein, Professional Officer (Poultry Research), College of Agriculture, Potchefstroom.

ONE of the rules of an egg-laying competition is that a hen is disqualified if she has lost ½ lb. or more in weight at the end of the competition. The hens are weighed at an interval of 48 weeks.

A period of 13 days may elapse from the day of the final inspection and weighing of the hen until the day she is received back by her owner. It has consequently happened that a hen which was disqualified under this rule, actually weighed more on arrival back home.

As a result of dissatisfaction over this matter on the part of competitors, representations were made to the Division for an investigation to be instituted into the possible reasons for the disparity in weights. This was done and according to the data available it was determined that broodiness could be the only possible cause. In order to obtain more information on the matter, all hens which became broody at this Institution between August 1941 and February 1942, were kept under observation.

The heavy-breed hens were kept in trap nests in order to determine exactly when the broody period of each hen commenced. By broody period is meant the time that elapses between the laying of the last egg and the laying of the first egg after she has clucked. This period can be sub-divided as follows:—Cessation of production; clucking period during which time the hen does not necessarily remain on the nest; the period during which the hen refuses to leave the nest; the period during which chicks are reared; and finally, the laying of the first egg.

As soon as it was observed that a hen started clucking, she was removed to an airy broody pen with a wire-netting floor. Here she was fed the usual dry laying mixture, plus grain, green-feed and clean water. Here the hens were housed separately until the first eggs were produced. Each hen was weighed as soon as she became broody and again after she had laid her first egg. Some hens start clucking on the day when they lay the last egg. In other cases up to five days may elapse before clucking is observed. Broodiness in hens is usually accompanied by hot weather. This does not mean, however, that hens do not become broody during the cold months. This does happen, but such cases should rather be regarded as exceptions. Not a single hen became broody at this Institution between the beginning of May and the end of July 1941. Most cases of broodiness occurred during the hottest period of the year, viz., November, December and January. Cases occurred as early as August and as late as April.

During the period under review 115 hens were kept under observation and consisted of 54 Australorps, 19 Rhode Island Reds and 42 Light Sussex.

Although the average period of broodiness was 18·95 days, there were hens which clucked and were removed to the brooding pen but which were out of production for only one day. On the other hand, however, there was one hen which was out of production for 47 days. On the whole, hens soon stop clucking after being removed to the broody pen. Some hens remain in a sitting position even when placed on wire-netting.

The average increase in weight was 0·66 lb. This means that a hen loses on an average more weight during a period of broodiness

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Stud Services for Farmers.

Dr. P. J. v. d. H. Schreuder, Senior Prof. Officer (Horses), Division of Animal and Crop Production.

SINCE the revival of interest in horse and mule breeding, the Government has strengthened its studs of horses and donkeys at the Colleges of Agriculture by the importation of fresh blood and the establishment of a new stud of American jack stock.

In addition, stud services were provided for selected farmers' mares by placing at stud Percheron and Thoroughbred stallions and donkey jacks at the small fee of one guinea per mare, and 2s. 6d. per week for grazing plus 1s. per day for stabling, if desired.

This scheme (Scheme B) has now completed its fifth year, and in spite of war conditions the number of mares forwarded has not decreased seriously. On account of the danger of dourine infection of valuable stallions, the Department had to apply the restrictions prescribed by its Veterinarian Advisers, and consequently the number of mares per stallion was rather low. In Scheme A the best stallions are used for Government-owned mares and are only available for selected and registered farmers' mares on condition that the mares are isolated for three months and then accepted after two negative tests for dourine.

Number of Mares Served.

Since the inception of the scheme, the following number of mares have been served under Scheme B.

Breed.	1938-39.	1939-40.	1940-41.	1941-42.	1942-43.	Total.
Percherons........	33	22	97	94	107	353
Thoroughbreds....	30	65	122	84	60	361
Jacks............	27	20	8	9	5	69
TOTALS	90	107	227	187	172	783

Stud services under Scheme B are provided at seven colleges and stations. The University of Pretoria also accepted a limited number of mares this season during heat periods only, while the Dohne Experimental Station will also receive mares next season. The following number of mares were served in 1942/43 at the various stations.

Stations.	Grootfontein College.	Elsenburg College.	Glen College.	Potchefstroom College.	Cedara College.	Pretoria University.	Ermelo Veterinary Station.
Percherons....	19	9	16	27	10	5	21
Thoroughbreds	—	—	21	10	—	—	29
Jacks.........	—	—	—	5	—	—	—
TOTALS.....	19	9	37	42	10	5	50

GRAND TOTAL: 172

Conditions of Service.

The conditions of service are obtainable from each of the above stations. Applications are not accepted unless accompanied by a veterinary certificate that the mare is free from dourine, but there

are other conditions often not carefully complied with by farmers and which have a direct bearing on results obtained.

Condition No. 1 stipulates: "Mares of good standard will be accepted . . . ."

Several Institutions have reported that occasionally mares of poor type have been forwarded. Such mares can be refused, but considering the expense and trouble involved, they are seldom returned without service. A more serious infringement of conditions, however, occur when untamed mares and mares in very low condition are forwarded. The conditions lay down that "No mare which is not fully broken to halter will be accepted". It is too risky to life and limb both of stallions and grooms to handle such mares and they are usually returned without service.

The mare in very low condition is a problem. The Institutions offer stabling at 1s. per day, but farmers very seldom avail themselves of this offer, and the mare fails to develop any oestrous. The low percentage of foaling is directly and mainly due to this retarding factor.

The factor of expense frequently quoted cannot always be accepted if it be realized that yearling foals bred under the scheme may be worth £50 and over for an outlay of £1. 1s. stud service: rail fare about £1, stabling for 42 days at 1s. p.d.—£2. 2s., grazing at 2s. 6d. p.w.—15s., making a total of £4. 18s.—a stud fee lower than elsewhere in the world and within the means of any farmer who owns a good mare.

Foaling Percentage.

The Department is experiencing great difficulty in collecting foaling results from farmers who forwarded mares. In areas with a better response for this information it has been established that the foaling percentage reaches 50. Although this is not a very good figure it is well above the percentage generally obtained in large horse- and mule-breeding propositions in South Africa. The long established and well organized U.S.A. Army Remount Stations report a 60 per cent. foaling, while Thoroughbred studs in England consider 50 per cent. very satisfactory. Apart from the annual sales of surplus stud stock (stallions and jacks) this scheme is the only direct assistance offered to farmers at present, and results in spite of many difficulties are such that it is considered to be very helpful in supporting the renewed interest in horse and mule breeding.

The Departmental Institutions are offering the best services within reason, and according to available facilities and if farmers are more careful in complying with the conditions as regards the type, condition and handling of their mares, better results would be obtained.

Another very important point in direct bearing on this scheme is the development of the progeny from these selected mares and valuable stallions. In the areas concerned almost every farmer reported satisfaction with the foals obtained and declared that they are not only an improvement on their dams, but possess a value far above the ordinary run of horse stock in their area.

Some 785 mares were served during the past five years by approved and valuable stallions. If the progeny enjoys approved attention the scheme is bound to have a marked influence on our horse stock in time to come.

The next season opens on 1 September and closes on 31 January 1944. Fuller particulars will be given in this journal and in the agricultural press at a later date.

The Draught Horse.

III. Breeding and General Management.

Dr. L. L. Roux and H. J. v. d. Merwe, Grootfontein College of Agriculture, Middelburg, C.P.

The Stallion.

THE value of a stallion is reflected in his ability to sire a large number of sound, vigorous, well-built foals. His inherent qualities can be brought out only by good care and management.

It is of great importance that stallions should be kept in good condition, but it is equally important that *they should not be over-fat*. In order to accomplish this, the stallion will have to be given plenty of regular exercise, and his feed will have to be regulated

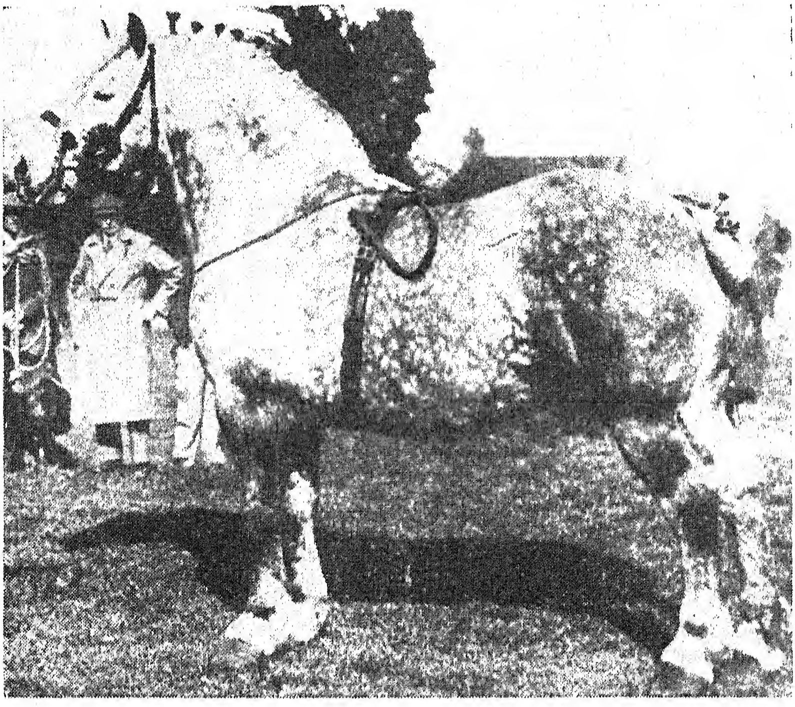

FIG. 1.—Percheron Stallion: March Viking. Owner: D. H. Truman, March, Cambridge, England.
[*Photo by Sport and General, London.*

from time to time, depending upon his age, the season of the year, and the work or exercise undertaken. Even during the breeding season, half a day's work will prove to be most beneficial. Walking five miles each day is considered sufficient exercise for a draught stallion.

Particular care should be exercised in feeding of maize to stallions. Whether or not a legume hay is fed, the maize portion of the concentrate ration should not exceed 50 per cent.

The amount of any ration fed will depend upon the individual capacity of the stallion. During the breeding season, the stallion

should gain slightly in condition. This is based on the assumption that the horse is in good hard breeding condition at the commencement of the season. The following general rule is proposed. Feed from $\frac{3}{4}$ to 1 lb. of concentrates and from 1 to $1\frac{1}{4}$ lb. of hay for each 100 *lb. body weight* during the breeding season. During the off-season stallions should be fed less grain and more hay.

Healthy stallions do not require drugs; good care will keep them thrifty, sexually active and potent.

Rations for a stallion.—The following rations are suggested:

(1) Oats, 80 per cent.; wheat and bran, 20 per cent.; grass hays.

(2) Oats, 30 per cent.; maize, 50 per cent.; wheat and bran, 20 per cent.; grass hays.

(3) Oats, 44 per cent.; maize, 44 per cent.; linseed meal, 12 per cent.; grass hays.

(4) Oats, 65 per cent.; maize, 20 per cent.; bran, 15 per cent.; legume hays and grass hays, 50 per cent. of each hay.

It is strongly recommended that stallions receiving high-level grain rations should not be fed phosphatic licks, but that calcium be supplied at the rate of $\frac{1}{2}$ to 1 oz. per head per day. Salt can be given in the feed or in the form of rock-salt. Investigations have proved that stallions fed rations deficient in calcium and phosphorus show a decided decrease in spermatozoa and loss of vigour of spermatozoa in their semen. Therefore, the fertility of such stallions is reduced.

The management of stallions during the mating season is most important. Very often foaling results are poor; a great deal of infertility in horses can be ascribed to a lack of understanding of proper management.

Most stallions are naturally easy to handle. Many become unruly owing to bad handling and perhaps careless and indifferent training as colts. The main object should be to get the stallion to do his work as quietly as possible.

In South Africa there is only one breeding season which commences in September and is restricted to about 5 to 6 months of the year.

The mares to be mated should be tested for oestrus or sexual heat. For this purpose it is decidedly preferable to use a teaser or special stallion, because the use of the stud sire may lead to excessive masturbation which is a potent cause of infertility in stallions.

Mares should never be teased or bred in the stallion's camp as this makes the latter restless.

The washing of the reproductive organs of the stallion with soap and warm water every morning during the service season and immediately before service will greatly reduce the chances of transmitting certain types of infection (streptococci) to the mare. Streptococci infection is harmful because it causes inflammation of the genital tract of the mare and prevents conception. It may result in abortion and is a cause of navel ill.

If handled properly, a two-year-old stallion may be bred to 10 to 15 mares a season. He should not be used for more than two services a week. Well-developed three-year-olds may perform one service a day regularly. A mature stallion may undertake two services a day; certain individuals can easily exceed this number. It is of interest to note that a case is reported of a Clydesdale stallion, "Dunure Footprint" that sired, by natural service, more than 200 living foals in one season, and he remained fertile until his death at the age of 19 years. Although American horsemen claim that three-

year-old stallions can breed from 35 to 50 mares, four-year-olds from 50 to 75 mares, and aged stallions from 75 mares upward, it is certain that such extreme demands should not be made under the climatic conditions of this country in which also the sexual season of individual mares is likely to be considerably shorter.

Accommodation.—Much of the success with a stallion will depend upon his accommodation. Dark, dirty box stalls will affect the temperament of the horse. The ideal stallion box is one from which routine yard operations can be seen. It is best to have an exercise camp adjoining the stallion box for, although the stallion may be given 5 miles of walking exercise a day, he will benefit far

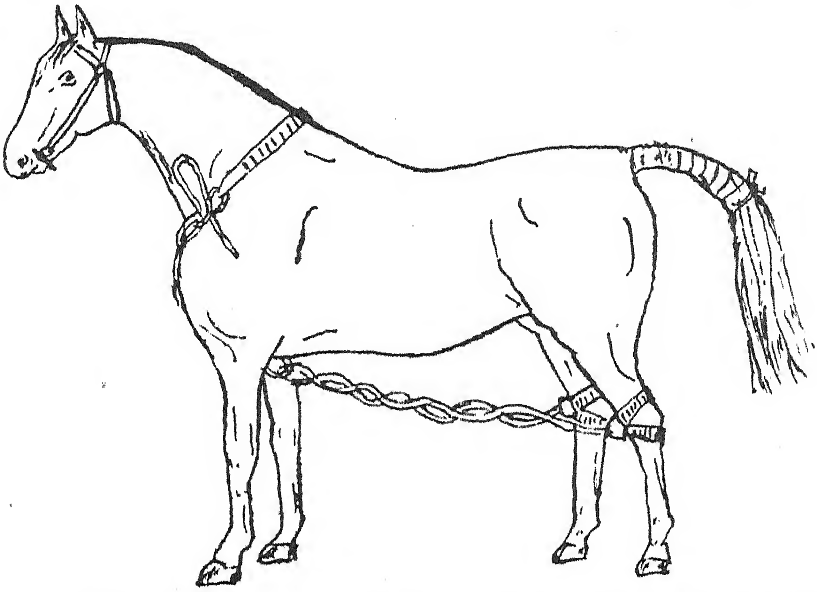

FIG. 2.—Service hobbles of the type illustrated are buckled round the hocks, another type fits round the pasterns. The tail is bandaged to facilitate service.

more by being allowed to exercise in his own camp where he can enjoy freedom and sunlight, but where he will be protected from the direct rays of the hot sun or from excessive cold.

Impervious floors should be well bedded. In parts of the country where bedding is scarce and, therefore, cannot be used in large quantities, floors made of thick wooden railway sleepers have been tried. In such cases, great care should be exercised in cleaning the stable frequently, and thoroughly disinfecting the floor.

The box-stall door should open directly into the exercise camp which should be long and narrow rather than square, as the stallion will take more exercise in one of the former shape.

A 7 or 8 ft. fence should hold the most active stallion. For relatively quiet stallions, the ordinary woven wire fencing is satisfactory; the lowest wire can be 2 to 3 ft. from the ground. In the case of restless stallions a double run of heavy fencing may be necessary.

On no account should barbed wire be used for the making of any camp for horses.

The Mare.

The working non-pregnant mare should be treated as outlined in the article on the feeding and management of work horses. (See *Farming in South Africa* of May 1943.)

The pregnant working mare should receive a little more grain than is prescribed for work horses. As foaling time approaches, 1 lb. of wheaten bran can be added to the ration as a laxative and conditioner, especially if the feeds and pastures are dry. The intensity of work should also be decreased as foaling time approaches, and when this is done, it will be necessary to diminish the grain ration to a corresponding degree.

The pregnant mare should receive due consideration, especially during the latter part of pregnancy; there should be no over-exertion, continued heavy hauling and backing. Under excellent supervision mares may continue with light work up to about one week before foaling, but if proper supervision is not possible, it will be wise to stop the use of mares several weeks before foaling and to allow plenty of camp exercise.

It is very important that the protein and mineral requirements of mares be fulfilled and this is especially true of pregnant mares. Bonemeal and salt may be fed or 1 oz. per head per day of a mixture of calcium phosphate and calcium carbonate may be given in the feed. Salt can be fed in the feed or in the form of rock salt.

Breeding.—It is not advisable to breed mares as early as two years of age; they are usually bred at three years. Mares should not be allowed to become too old before starting to breed, as difficulties in breeding often increase with age.

In South Africa the breeding period of horses is seasonal and the longest is from August to April. Individual mares differ a great deal in sexual activity; some exhibit oestrus or sexual heat only once or twice during a season, while others experience several oestrous periods. Heat in the mare normally occurs about 7 to 9 days after foaling. This first heat period is short, lasting only from 3 to 4 days. Subsequent heat periods occur at intervals of 18 to 21 days and these periods are normally of 7 to 9 days' duration. Mares are encountered which stay on heat continuously for 30 days and longer. This is due to the fact that follicles fail to rupture. Recent researches have shown that rupture can be precipitated by suitable hormone treatment.

During normal oestrus, an ovum or egg is set free from either one of the ovaries. The egg enters the fallopian tube, passes down its length and enters the uterus. One of the spermatozoa in the semen of the stallion fertilizes the ovum, after which it becomes attached to the wall of the uterus in which development then takes place. It has been found that ovulation generally occurs during the latter part of oestrus. As spermatozoa can live in the genital tract of the mare for only a limited time, service should be given during the latter part of the oestrus period. Hence, during the *first heat period* after foaling, service should be given on the 8th or 9th day *after foaling*, while during subsequent heat periods, service should be given on the 5th and 7th day of oestrus and again on the 9th day, should the mare continue to show oestrus.

The best time for foaling will depend very largely on local conditions. In most areas early foals are preferred. The need for immunizing against horsesickness must also be considered. Horsesickness vaccine is issued by the Director of Veterinary Services only from 15 June to 15 December of each year. A reaction may be

noticeable on the 7th to the 14th day after injection. Early-foaling mares should be inoculated after foaling, and late-foaling mares should be immunized at least two months before foaling.

At the commencement of the breeding season, mares may be tried once or twice a week in order to ascertain whether they have started their sexual season. Some horsemen report that it is sometimes difficult to find young mares in season. In such cases, it may

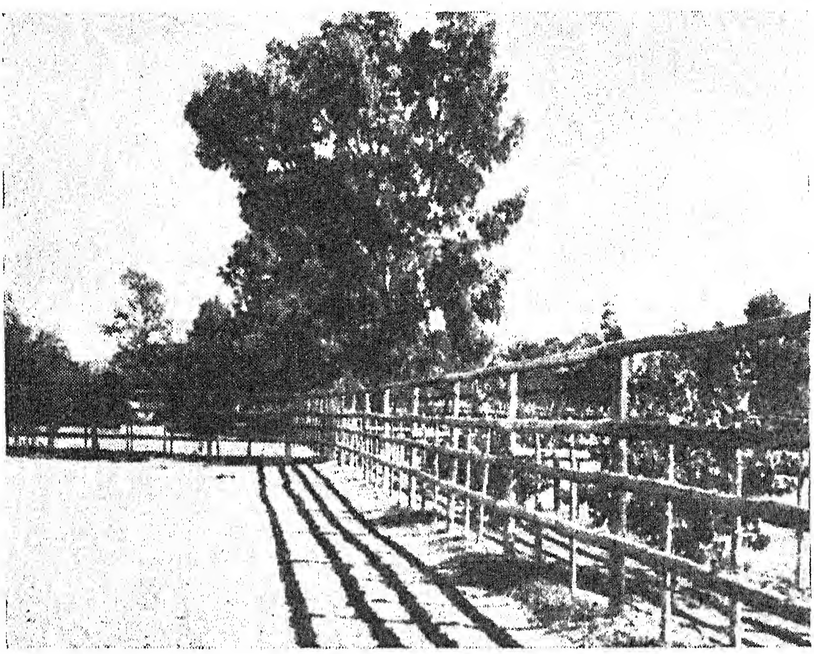

FIG. 3.—Well-shaded, safe exercise yards or paddocks are useful for stallions, mares and foals.

be best to lead the stallion into the camp of the young mares and allow him to cover any mare that comes to him.

Successful services can be given without undue fuss and difficulty, provided the stallion is properly trained and the handling of the animal is consistent from day to day. Also, the preparation of the mare is most important. The tail should be bandaged to prevent the hairs from interfering with service and causing injury to the penis. Service would further be facilitated by tying the tail alongside the body by means of a tape, which should be secured to a loosely fitting tape around the neck. In the case of nervous, especially strange mares, the use of service hobbles guards the stallion against being kicked. The twitch should be used only on mares that are very difficult to control.

The danger of introduction of infection at the time of service has been referred to. A further precaution can be taken in this connection by bandaging the mare's tail for 6 to 8 inches and thoroughly washing the external organs of the mare with soap and water, after which a thorough rinsing should be given.

The mare should be allowed to rest after having been served. She should not be worked while still on heat and, even if heat passes off the next day, the mare should be rested for a few days.

The average gestation period of the mare is 11 months or approximately 340 days.

Foaling.

If conditions permit, mares should be allowed to foal on clean fresh pasture where shade, shelter and water have been provided. Mares should not be allowed to foal on the ground unless the nights are warm and the ground is free from dampness. The mares that are about to foal should not be run with other horses or mules. At this stage, proper management minimises loss through accidents. Small well-sheltered paddocks are most convenient as foaling paddocks, and wherever possible, they should be covered with grass. If they are fenced, wooden fences are preferable; *barbed wire should never be used.* Should a suitable foaling paddock not be available, a thoroughly cleaned, well-bedded loose box, about 16 by 16 feet, should be prepared.

Wax forms on the teats about 3 days before foaling. At about the time of foaling, the mare shows marked signs of nervousness, walking about, lying down, getting up, and urinating frequently. She should be left undisturbed, but a mare that is about to foal should be visited by the attendant at least twice during a night. The normal presentation of the foal is with the fore-feet first. The head lies on top of the fore-feet and the nose appears after the former have emerged about 8 to 10 inches. Normal delivery usually does not require more than 20 to 30 minutes. If there is marked delay, experienced assistance should be obtained. If the feet are presented with their soles up, they are generally the hind-feet and the foal should be extracted at once or it may smother. The soles of the front feet are turned up when the foal is presented on its back. The foal should breathe as soon as it is dropped. If not, artificial respiration should be given. As soon as the foal has been delivered, all mucus should be removed from the head and the mouth and the nostrils should be cleaned. The afterbirth should be doubled up and tied with a piece of string in order to prevent the mare and foal from treading on it and to lessen the danger of infection resulting in "foal founder" (joint ill). If the afterbirth is not discharged within six hours, the assistance of a veterinarian should be obtained. The loose box should be cleaned, sprinkled with lime and re-bedded as soon as opportunity offers.

A light feed of bran is suitable for the first meal. About ½ quantity of normal ration should be given for the first 9 to 10 days. This can consist of two-thirds oats and one-third bran. Good mixed hay (legume and grass) should be given.

The New-born Foal.

It is desirable to ligature the foal's navel if one is certain that no contamination has taken place. However, since some degree of contamination nearly always occurs unless the foal is received into a clean stall, ligaturing is not advisable and swobbing with tincture of iodine is usually sufficient to prevent serious infection. The iodine treatment should be continued until the navel has dried and healed. The cord generally falls off within three or four days.

If the foal does not nurse within 3 to 4 hours, it should be assisted; it should be coaxed and not forced.

The foal should have the first milk to come from the mare's udder, as it cleans the intestinal tract of the faecal discharges. Dr. J. Quinlan gives the following advice upon treatment of cases in

which the bowels fail to discharge within four hours and the foal does not take much nourishment:

" Give an injection of olive oil, using a rubber nozzle. The hard balls of meconium should be removed with the fingers. If constipation continues, repeat the injections of olive oil. There is little use in giving a purgative through the mouth, because the foal will succumb to colic unless constipation is relieved very soon.

" When foals appear weak and die, the trouble may be due to pre-natal infection, and, according to Dr. W. W. Dimock, Head of the Animal Pathology Department, University of Kentucky, a large percentage of such foals could be saved by injecting them intravenously with 50 c.c. of blood taken from the jugular vein of the mare ".

The foal should be watched carefully to see if it passes water. In some cases the navel fails to close and the urine continues to pass through it, the assistance of a veterinarian should be obtained.

The mare and the foal should be put out for exercise after 4 to 5 days if weather conditions are favourable. They can be put on good pasture, if the mare was accustomed to pasture before foaling.

While some mares are capable of doing light work 10 days after foaling, it is best to wait, especially if the mare is served on the 8th or 9th day after foaling.

The foal should be left in the loose box while the mare is at work. A supply of water and grain should be left in receptacles which are not dangerous. If the mare is at work, the foal should be allowed to suck from the mare once in the morning and once in the afternoon during the first 10 days. Mares that are heated owing to work must be milked a little and the udder washed with water before the foal is allowed to suck.

Rations for Brood Mares.

The following rations are suitable for brood mares nursing foals, but not at work. The selection of a ration will depend upon other factors of treatment, especially the nature of the pasture.

(1)	Lucerne or soybean, or cowpea hay	16 lb.
	maize or other grain	6 lb.
(2)	Mixed legume and good grass hay (30% legume)	16 lb.
	oats	6 lb.
(3)	Good grass hay	16 lb.
	oats	3 lb.
	bran	3 lb.
	linseed or other high protein supplement	1 lb.

If the mare makes a normal recovery after foaling, she may be bred on the 9th day after foaling, but if she shows vaginal discharges, service should be withheld. An authority states: " many cases of pre-natal navel ill due to streptococci infection occur because the parturient mare has streptococci in the genital tract ".

(The concluding article of this series will deal with the " Rearing of Foals ".)

Pregnancy-disease or Domsiekte in Ewes.

R. Clark, Onderstepoort.

THIS disease has long been known in South Africa, and appears most commonly in the Karroo and in the western Cape Province. It occurs in practically all countries where sheep are kept. The disease is nearly always confined to heavily pregnant ewes, within about a month of lambing. Although domsiekte is not one of our most important sheep diseases, it can cause severe losses of both ewes and lambs. Valuable stud ewes are very often affected.

The first thing usually noticed about an affected ewe is that she lags behind the flock and often remains in the veld when the others have returned to the kraal. At first the sheep may be nervous, with twitching ears and a high-stepping gait. In this stage spasms may pass over the body at intervals, rather as if the animal had hiccoughs. Very soon, however, the animal shows the typical dullness and stupidity which have given rise to the most descriptive Afrikaans name, " domsiekte ". The animal often becomes blind either in one eye or in both, and does not eat or move with the flock. A domsiekte sheep will often stand quite still while the rest of the flock is driven past it. Later the animal goes down and lies as if fast asleep in deep coma from which nothing can rouse it. This stage may last a day or more before death. Sometimes ewes abort in the earlier stages and then recover.

Condition of Liver.

At post-mortem it is usually noticed that the sheep is heavily pregnant and in good, fat condition. The only really striking change seen in the organs is that the liver is very pale, often being a yellow khaki colour and very soft. This change is due to a large amount of fat in the liver which can often be seen on the knife and felt with the fingers. The typical symptoms and fatty liver, occurring in ewes heavy in lamb, should enable every farmer to recognise the disease.

The cause of the disease has long been a mystery, but it has now been shown at Onderstepoort that if fat, heavily pregnant ewes are suddenly put onto a poor diet of dry hay they contract domsiekte within a few days. Older ewes are more susceptible than young ones and the better the condition of the ewe the quicker the disease appears. It can, therefore, be stated that the cause of the condition lies in the feeding or management. The idea that domsiekte was due to a mineral deficiency and could be cured or prevented by feeding bone meal can now be discarded altogether.

There are very good scientific reasons to explain how a sudden reduction in diet can cause domsiekte, but these need not be gone into here.

The fact that the fatter the sheep, the more liable it is to get domsiekte explains why stud ewes are often affected.

Sudden Changes.

As it is unlikely that any farmer would feed his sheep well for the first four months of pregnancy and then suddenly starve them, we will try to explain how this may happen in practice.

The first case in which this may happen is, naturally, if the sheep are given a grain such as mealies and this is suddenly stopped at the critical time.

Another and more common cause would be a sudden change in the grazing which might occur owing to a sudden frost, or drought or owing to the water supply to irrigated lands failing. It is interesting to note that domsiekte often appears after a sudden change in the climate.

The same effect might be brought about without any change in the feed or grazing if the sheep suddenly stopped feeding. A few days of cold rain may easily put sheep off their feed and if they are fat and heavily pregnant at the time they may get domsiekte in spite of the fact that plenty of food is available.

It must also be remembered that sheep, and especially pregnant ewes, are very sensitive to changes in their habits and environment. A change of camp at the critical time, although possibly for the better, may upset the sheep and cause them to eat little or nothing for a day or so. Sudden changes in the weather may have the same effect.

A peculiar fact about heavily pregnant sheep must be stressed here. It has been noted at Onderstepoort that if these ewes are deprived of their food for even one or two days they refuse to eat when food is again offered. This is not the case with other classes of sheep. The explanation may be that a fat, heavily pregnant sheep begins to feel ill from domsiekte long before anything can be seen, and so it does not feed. This means that, in practice, it is not necessary for the sheep to be off their feed for long to cause the disease.

It must also be remembered that any other illness will put sheep off their feed, especially trouble in the stomachs or bowels. Constipation or diarrhoea from any cause will not only stop the sheep eating, but will also prevent the absorption of the foodstuffs into the body, which will have the same effect.

Certain poisonous plants, such as "Sprinkaanbos" cause severe constipation and loss of appetite and so may, indirectly, cause domsiekte.

Prevention and Treatment.

The prevention of domsiekte is a matter of flock and grazing management. The main point is to see that the ewes maintain their weight during the last stages of pregnancy. Although pregnant ewes should, of course, be well fed, it is better not to have them in over-fat condition, as this makes them more likely to suffer from the disease. The feeding and grazing of the pregnant ewes should be well planned beforehand so as to avoid, as far as possible, the necessity for making changes near the lambing time. Should the weather change suddenly just before lambing, the sheep should be carefully watched for cases.

There is unfortunately no sure cure for the disease, but in treatment we must try to give the food which is lacking, and get the bowels working. Constipation is almost always present in these cases. The food most required and most easily absorbed by the body is sugar. The following dose can, therefore, be given:—

Raw linseed oil about 4 oz., or 3 or 4 oz. Epsom salts.

Sugar ¼ lb. dissolved in water or given dry, and a tablespoonful of vinegar.

Dosing with Tube.

It must also be remembered that the animal usually refuses to drink and so must be dosed with water. When the animal is in the coma stage is cannot be dosed as the fluid will run down into the lungs and cause pneumonia. The only safe way to dose in this case is

with a tube. A fairly stiff piece of rubber tubing, about ½ inch in diameter and 2 feet long, is required. Smear the tube with oil or vaseline and open the sheep's mouth as for ordinary dosing. Poke the end of the tube along the top of the tongue to the throat and let the sheep swallow, then push another eight or ten inches of the tube gently in. Feel just behind the wind-pipe about the middle of the neck on the left hand side. If you can feel the end of the tube moving down the neck when you push it, you can be sure the tube is in the gullet. Now fix a funnel to the end of the tube sticking out of the sheep's mouth and simply pour in your dose. This is a very safe and clean way of dosing and, with practice, can be done quite easily. The only danger is that the pipe may go down the wind-pipe. This rarely happens, but if it does, the sheep will cough and struggle violently. The air can also be heard as it is sucked in and blown out of the funnel with each breath. As the windpipe is a stiff-walled tube, you will not be able to feel the rubber tube inside it.

The main object in the treatment of domsiekte must be to try to get the bowels to work and to get the sheep to feed. In the meantime, to keep up the sheep's strength, sugar water must be given.

In conclusion, the Director of Veterinary Services would greatly appreciate it if farmers would report outbreaks of domsiekte, giving the following details:—

(1) The date of the outbreak and the date the ewes were expected to lamb.

(2) The condition of the affected ewes (fat, medium or poor).

(3) Any change made in the feeding or any change in the weather about a week before the outbreak.

Such practical observations will greatly assist in our understanding of the cause of the disease, and may be helpful in improving our advice on its prevention.

Contribution of Agriculture to National Income of the Union:—

[*Continued from page 567.*

£800,000, i.e., £2,850,000 per annum. To this, however, must still be added the interest on borrowed capital for *running* expenses. No figures are available for this. Running expenses, however, amounted to approximately £28,000,000 (according to Table 2). Assuming that farmers have borrowed one-quarter of this amount at 7 per cent. p.a. for a period of 12 months (during the period in question banks at times charged interest at 8 per cent. p.a.), the interest on money borrowed in respect of running expenses would amount to approximately £490,000 per annum. The total amount for interest can, therefore, be estimated at approximately £3,340,000 per annum.

This amount, subtracted from the £17,857,000, mentioned above as the net income of the industry, therefore leaves a balance of £14,517,000, which represents the average net income from all branches of farming enterprises exceeding one morgen (including those of „ bywoners " and share croppers who farm on their own account; it also includes the income of a small number of Coloureds and Asiatics who farm on their own account).

Control of the Sheep Blowfly.

II. Selection and Breeding for Less Vulnerable Merino Types.*

H. C. Bonsma, Sheep and Wool Research Officer, and A. H. de Vries, Entomologist, College of Agriculture, Grootfontein, Middelburg, C.P.

DURING the past few years the sheep blowfly pest has played a particularly prominent part in making merino sheep farming less attractive. Large sums of money are spent every year in an attempt to control the pest, but hitherto the results have not been very encouraging. If sheep die as a result of blowfly attack a direct pecuniary loss is sustained, but this is not all. There is, in addition the loss of wool due to crutching and the indirect effect of blowfly strike on wool growth, since severely infested sheep rapidly fall off in condition. These factors are responsible for a continual increase in the costs of wool production and that at a time when the problem of obtaining sufficient labour is becoming extremely critical. Consequently, farmers are beginning to pay increasing attention to cross breeding for the simple reason that, as is generally known, cross-bred sheep are less vulnerable to blowfly attack than the merino.

As soon as cross-breeding is resorted to, especially in those areas which are and must remain pre-eminently merino areas, new problems immediately arise. Kemp and black fibres generally occur in those breeds from which the rams are selected, and it is these undesirable characteristics which the merino farmer must eliminate from his flock by severe selection and breeding. Characters which have been built up after years of careful breeding are destroyed in a single generation. To-day we have on the market a great variety of blowfly remedies which are alleged to possess disinfectant as well as repellent properties. A certain measure of success has admittedly been achieved with the use of these remedies, but the regular kraaling of sheep at least once a week, especially on large farms, sometimes involves considerable labour and may even be a practical impossibility for the farmer. The repeated rounding up of sheep is also a very unsound practice, especially when the animals graze in extensive camps. The continual driving of sheep results in unnecessary loss of energy and the animals rapidly fall off in condition. This, in turn, may have an adverse effect on the sexual activity of the ewes and, consequently, result in poorer lamb crops. In addition, frequent handling of the sheep causes considerable quantities of dust and other foreign matter to lodge in the wool which then becomes less attractive.

Blowfly Infestation on Developed Sheep.

A moot point is whether the merino has not assumed a conformation extremely vulnerable to blowfly attack as a result of the breeding policy followed in the past. The endeavour to increase the yield of wool per sheep, which was accompanied by a certain amount of skinfold development, resulted in the evolution of a type of merino in which a large percentage of the ewes, even in the case of plain-bodied animals, have a certain amount of fold formation along the vulva, or perhaps also from the tail downwards as far as the crutch. As will appear from the experimental data given below, it is this very part of the sheep which is so extremely vulnerable to blowfly attack.

* See first article in July issue.

In view of the above, it is obvious that the problem of blowfly control should not be tackled from one angle only, namely, by controlling the pest alone, but that the aim should also be to produce a less vulnerable type of sheep by careful breeding and selection. Observations on blowflies on a number of flock ewes during the past three years reveal that it is indeed possible to attain practical success along these lines.

Technique.

For experimental animals 250 merino flock ewes were used mainly for testing the respective merits of shearing at intervals of six, eight and twelve months. The ewes were representative of the Grootfontein flock, which must be described as plain-bodied merino flock ewes.

All the ewes were inspected regularly once and, if deemed necessary, twice per week for blowfly strike. Every case of attack was very carefully recorded, i.e., the number of the ewes, the date of attack and the exact spot on the body where the sheep was struck. The infested areas were then shorn clean and treated with a standard blowfly mixture.

For the rest, the ewes were treated in accordance with the requirements laid down for the six months' as against the eight and twelve months' shearing test, i.e., the sheep were always run in a single flock under ordinary veld conditions and were mated, shorn and crutched at definite times. Blowfly attacks were recorded according to the above method over a period of two years, namely, from September 1939 to September 1941.

During September 1941 all the ewes were classed into 4 types as follows:—

Type A.—Ewes with a smooth crutch and without lateral folds. Ewes with a very small medial fold on each side of the vulva were included in this group. No tail folds were allowed, however, and the tail had to be of normal length, i.e., docked in at least the second joint.

Type B.—Ewes with a faulty tail, i.e., tail with skinfolds, horseshoe tail or split tail. The latter type of tail is due particularly to excessively short docking.

Type C.—Ewes with prominent lateral and/or medial folds in the crutch but with a normal tail, i.e., not docked too short, and without folds on or around the tail. Ewes with a crooked vulva were also included.

Type D.—Ewes with lateral and/or medial folds, as for type C, and also faulty tail, as described under B.

This classification of ewes was made without any reference whatever, either at the time of or before the classing, to the number of times that such a ewe had been attacked during the period of the experiment.

Experimental Data.

In Table 1 particulars are given of blowfly attacks as observed on four groups during the two years.

1. *Vulnerability of various types.*

(*a*) Only 11·92 per cent. of the sheep of type A were attacked during the two years, as compared with 81·16, 93·93 and 89·74 per cent. for types B, C and D, respectively. This striking difference in the vulnerability of the various types clearly shows that merino ewes which are plain in the breech and have a normal tail, were practically free from blowfly attack.

(*b*) Out of a total of 250 ewes, no fewer than 109 or 43·6 per cent. fell under type A, and of these only 5·96 per cent. per year

were attacked. This is a point of the utmost importance in selecting and breeding for insusceptibility to attack.

(c) Types B, C and D include ewes, almost all of which were highly susceptible to blowfly attack. Of these ewes, 41·47 per cent. were attacked once or more each year. These three groups, consisting of 141 ewes, were attacked no fewer than 309 times in the course of the experiments, as against only 14 attacks in the case of the 109 type A ewes during the same period.

2. *Particulars of attacks.*

Type A (ewes plain in the breech).—Of the 14 attacks recorded in connection with this group, 57 per cent. occurred on the tail, 36 per cent. along the vulva and only 7 per cent. below the vulva. Only one sheep was attacked more than once during the two years, which also proves that the group as a whole was not susceptible to blowfly attack.

TABLE 1.—*Number of blowfly attacks during 2 years.*

Type of sheep.	No. of ewes.	No. of times attacked.	Where attacked.				No. of sheep attacked.	Percentage of sheep of group attacked.	Percentage of sheep attacked per year.
			On body.	On tail.	Along vulva.	Under vulva.			
A. Plain in the breech.......	109	14	0	8	5	1	13	11·92	5·96
B. Faulty tail.....	69	125	12	75	37	1	56	81·16	40·58
C. Medial and lateral folds.....	33	59	5	3	47	4	31	93·93	46·97
D. Medial and lateral folds and faulty tail....	39	125	7	44	70	4	35	89·74	44·87
TOTAL.....	250	323	24	130	159	10	135	—	—

Type B (faulty tail).—Of the 125 attacks in respect of group B, 75 cases (or 60 per cent.) occurred on the tail, which proves that a faulty tail is indeed the most important and attractive part of the body for blowflies. It should also be mentioned that the 12 cases of body attacks occurred in this group, and that all infestations originated on the tail from where they extended to the rump. Some of the sheep in this group were attacked on the tail no fewer than 7 times. (Compare results with Type A.)

The fact that 30 per cent. of the attacks occurred along the vulva, indicates that this part too is very vulnerable.

During the classification of the sheep into the four different types, difficulty was sometimes experienced in assigning each ewe to a particular type, especially since the line of demarcation between the types could not always be definitely determined and, consequently, the attacks did not always completely correspond with the selection of types.

Type C. (medial and/or lateral folds).—The 33 ewes in this group were attacked 59 times, and it is worthy of particular note than 47 (79·7 per cent.) of the attacks occurred along the vulva and only 9·1 per cent. on the tail. The large percentage of attacks along the vulva is therefore due to fold development in the crutch of these ewes. The classification of the sheep in this group corresponds very closely with the actual attacks as recorded. Some of these sheep were attacked 7 times, on 6 occasions along the vulva.

Type D (medial and/or lateral folds and also faulty tail). According to the classification these sheep should have been exceptionally vulnerable types, and this actually proved to be the case since the 39 ewes were attacked no fewer than 125 times, 44·4 per cent. of the attacks occurring on the tail and 56 per cent. along the vulva. The infestations which occurred on the body all originated on the tail or along the vulva.

3. *Incidence of attacks.*

The 323 attacks recorded occurred on the following parts of the body: On body, 24, or 7·4 per cent.; on tail, 130, or 40·2 per cent.; along vulva, 159, or 49·2 per cent.; below vulva, 10, or 3·1 per cent.

From the foregoing data it therefore would appear that attacks on the tail and along the vulva were by far the most common. The attacks on the body, which constitute 7·4 per cent. of the total, all occurred along the hindquarters or on the rump. The infestation invariably started on the tail or along the vulva and spread to the hindquarters or rump only as a result of the extensiveness of the attack. Consequently, actual "body attacks" did not occur.

The fact that only 3·1 per cent. of the attacks occurred directly below the vulva proves that this part as such is not particularly vulnerable.

4. *Ewes repeatedly attacked on the same spot.*

The following analysis clearly show that sheep are repeatedly attacked in the same place in spite of the fact that such a spot has been shorn clean and treated with a standard mixture.

(1) *Tail attacks:* 28 Ewes which were attacked twice or more and in respect of which the first attack occurred on the tail, on further analysis give the following data:—

No. of Ewes.	Total No. of times attacked.	No. of times attacked on tail.	No. of times not attacked on tail	No. of times attacked on the same spot
28	105	86	19	81·9

(2) *Attacks along Vulva:* The same procedure was followed in the case of 42 ewes which had been attacked twice or more, and in respect of which the first attack occured along the vulva.

No. of Ewes.	Total No. of times attacked.	No. of times attacked along vulva.	No. of times not attacked along vulva.	Percentage of total attacks along vulva
42	143	111	32	79·6

The chances of a second attack occurring on the same spot were 81·9 per cent. in the case of tail attacks, and 79·6 per cent. in the case of attacks along the vulva.

From the above data we must conclude that merino ewes are not attacked at random at any point in the crutch, but that they are repeatedly attacked in the same place owing to the presence of *some vulnerable spot in this region.*

Despite crutching and the treatment of the attack region, maggots again appeared on the same spot, which clearly proves that the ewes will remain vulnerable to blowfly attack throughout her life owing to her particular conformation.

Discussion.

The above experimental data point to the practical application of:—

1. *Selection:* The above experimental data bear out the results obtained by various research workers in Australia, namely, that blowfly attacks are mainly concentrated in the crutch of merino ewes. Actual attacks on the body seldom occur in the Karroo owing to the prevailing dry climatic conditions.

What is of importance, however, is the fact that 40·2 per cent. and 49·2 per cent. of the attacks occurred on the tail and along the vulva, respectively. No less than 89·4 per cent. of all attacks occurred on these two areas.

Attacks on the tail are due mainly to excessively short docking. If the tail of a ewe lamb is severely docked, and especially if medial and/or lateral folds are present, the tendency of such folds is to press against one another, with the result that the ewe continually wets herself. Not only is such a spot very vulnerable to attack, but the continual wetting causes irritation of the tip of the vulva which is ultimately destroyed, with the result that the position is aggravatd. If the tail is long enough and reaches to below the tip of the vulva, it naturally pushes the medial folds away so that there is much less likelihood of the ewe wetting herself. In addition, a ewe with a long tail always lifts it when urinating, and her vulnerable parts consequently remain dry.

It is therefore very easy in practice to reduce the incidence of blowfly attack in this quarter considerably by docking the tails of merino lambs to a length of at least 4 inches. This procedure has already yielded successful results in Australia, and similar experiments at the Grootfontein College of Agriculture are yielding closely corresponding results, in spite of the fact that they have been in progress for only one year.

Another point of considerable practical importance is that fact that, out of a total of 250 ewes, 109 were free from lateral folds, while medial folds were present only to a small extent. The experimental data clearly showed that such ewes were much less vulnerable to blowfly attack than those in which fold development was prominent in this region.

It is therefore possible to eliminate such vulnerable types from the flock by selection and in this way considerably reduce the incidence of blowfly attacks. Observations on the blowfly have also revealed that ewes with a goose-rump or very closely set aitch bones, are more vulnerable than those with a straight top line and broad hind-quarters. In addition to the abovementioned factors, these two points of conformation should therefore also receive attention in the selection of less vulnerable types.

Owing to the presence in a flock of these ewes which are repeatedly attacked, the farmer is compelled to round up his whole flock regularly and to examine them all for blowfly strike. In reality, therefore, only a part of the flock is mainly responsible for the high cost of controlling blowfly in the whole flock.

2. *Breeding:* (*a*) *Flock sheep.*—In selecting flock rams, it is of the utmost importance not only that close attention should be given to wool qualities and general conformation, but that special care is also taken to ensure that the ram is plain in the breech and has as few lateral and/or medial folds as possible. If only such rams are used continually in the flock, the succeeding generations of flock ewes must inevitably also be predominantly plain in the breech.

It is fully realized that difficulty will be experienced to-day in obtaining flock rams of the desired type, but if purchasers consider this character, namely, plainness in the breech, essential in rams, stud breeders will be compelled to give attention to this matter, since their very existence depends mainly on the demand for flock rams, and the farmer who concentrates on flock sheep is the person who creates that demand.

(b) *Flock Sheep.*—Another point of importance in the selection and breeding of sheep is that merino stud farmers should endeavour to produce not only stud ewes, but also stud rams which are plain in the breech, since stud farmers supply the flock farmer with rams. Judged by its appearance a flock ram may look insusceptible but, if his ancestors showed prominent fold development, he will almost certainly produce off-spring with similar development.

Selection and breeding for insuspectibility should, therefore, begin with the stud breeder, since his work is the foundation of our sheep-farming industry. Whether flock sheep will be predominantly vulnerable or not, therefore, depends mainly on the breeding policy followed by the stud breeder.

That success in breeding invulnerable types can be attained only after years or hard work is fully realized, but in view of the importance of blowfly control, that work will be fully justified.

In future, therefore, it will be the duty of the merino stud farmer to pay the necessary attention to this important problem by breeding less vulnerable flock rams, and by strictly and consistently adhering to this policy.

In conclusion, it may be mentioned that an experiment which has as its object the breeding of merino sheep which will be less vulnerable to blowfly attack has already been started at the Grootfontein College of Agriculture with funds made available by the Wool Council.

(Also see article by A. H. de Vries on this subject in July issue of *Farming in S.A.*)

SHORTAGE OF TETROL.

THE Director of Veterinary Services, Onderstepoort, announces that owing to the shortage of one of the ingredients of tetrol it is at present no longer possible to prepare supplies of this remedy. In view of the prevailing war conditions, it is extremely difficult to say when supplies will be available again, but as soon as this Institution is able to resume the preparation of tetrol, the necessary notification will be given in regard to the matter.

Farmers are therefore requested not to place any further orders since any money forwarded, must merely be refunded.

Popular Bulletins.

(1) Calf Rearing—Bulletin No. 224. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

(2) The Export of Fresh Grapes from the Union of South Africa during the Ten-year period, 1930-39—Bulletin No. 225. Price 6d. Obtainable from the Chief, Division of Horticulture, Pretoria.

(3) Soft Cheese as a Food—Bulletin No. 229. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

The Future of Wool.

Dr. L. L. Roux, Senior Professional Officer, Sheep and Wool Research, Grootfontein College of Agriculture.

PRODUCERS of natural textile fibres, such as wool, cotton, silk, flax, etc., will, in the near future, encounter increased competition from already well-established textile fibres and from newly developed filaments with properties not merely equal to those of the natural fibres, but in some respects superior.

Economists who have made a careful study of the present position of wool, with a view to its likely future rôle in the textile industry, are convinced that " the only ground on which the wool grower can combat synthetic fibres is that of cost of production ". Those who are concerned with the many aspects of the manufacturing side are advocating a planned policy of production and progress based on new bold lines. They are realizing the need for schemes of trade promotion and for technical progress in all directions on a basis of constant research.

World Production of Cotton, Wool, Silk and Rayon.
(Millions of lb.)

	COTTON.		WCCL.		SILK.		RAYON.		TOTAL.	
	lb.	%	lb.	%	lb.	%	lb.	%	lb.	%
1921.	7,250	79	1,830	20	77	1	49	—	9,206	100
1922.	8,825	81	1,820	17	82	1	77	1	10,804	100
1923.	9,125	82	1,800	16	88	1	104	1	11,117	100
1924.	11,500	84	1,820	14	97	1	139	1	13,656	100
1925.	12,800	85	2,010	13	104	1	186	1	15,100	100
1926.	13,400	84	2,140	14	111	1	214	1	15,865	100
1927.	11.200	81	2,170	16	118	1	299	2	13,787	100
1928.	12,400	82	2,250	15	129	1	366	2	15,145	100
1929.	12,600	82	2,250	14	134	1	441	3	15,425	100
1930.	12,100	81	2,210	15	130	1	457	3	14,897	100
1931.	12,700	82	2,230	14	126	1	508	3	15,564	100
1932.	11,200	80	2,200	15	116	1	535	4	14,051	100
1933.	12,500	81	2,170	14	122	1	691	4	15,483	100
1934.	11,000	78	2,120	15	125	1	824	6	14,069	100
1935.	12,600	79	2,160	13	121	1	1,081	7	15,962	100
1936.	14,700	80	2,230	12	119	1	1,322	7	18,371	100
1937.	17,600	81	2,280	10	121	1	1,819	8	21,820	100
1938.	13,200	75	2,340	13	123	1	1,946	11	17,609	100
1939.	13,100	73	2,420	14	123	1	2,227	12	17,870	100
1940.	14,100	74	2,360	12	127	1	2,381	13	18,968	100

Coton.—New York Cotton Exchange Service, converted to lb. on the basis of 478 lb. per bale.

Wool.—Grease-equivalent figures from the Wool Situation, United States Bureau of Agricultural Economics, converted to scoured basis shown at 60 per cent. of grease.

Silk.—1921 to 1937, League of Nations' Statistical Year Book; 1938, forward, Commodity Exchange Inc., bale-age data converted at 132¼ lb per bale.

Rayon.—Filament yarn plus staple-fibre.

Source: " Rayon Organon ", New York.

Important Textile Fibres.

A brief survey of the relative importance of the main textile fibres will be of interest, as it is considered to be of value in estimating the relationship between the different textile fibres.

Wool is especially suitable for clothing and carpet manufacture, the lower grades being used for the latter. Flax is used for materials which are subject to repeated washing, while articles of general household use are made of cotton. Real silk, because of its high lustre, fineness, and strength, is used for durable and luxury articles.

Artificial textile fibres, of which rayon is the most popular, are used in the manufacturing of a wide range of fabrics, such as women's dress and suiting materials, men's sports wear, men's summer suitings, blankets, etc. Rayon is extensively used in combination with wool, because of its price, style, and serviceability. Because of its textile qualities it has become wool's chief competitor.

The accompanying table reflects the world's production of cotton, wool (clean), silk, and rayon (filament and staple fibre) for a period during which important world-wide industrial development took place.

The production figures reveal that a record was established in 1937 when more than twice the total production of 1921 was reached. During 1940, the total production was 13 per cent. below that of 1937. Rayon was the only fibre to set a production record in 1940 when, for the first time, rayon (filament and staple fibre) exceeded the world production of raw wool (clean basis). In the four fibre groups, rayon and wool represents 13 and 12 per cent. respectively of the total world's production. A point of interest in connection with synthetic fibres is the position of the improved rayon staple fibre as opposed to rayon filament. In 1940 the world production of rayon staple fibre surpassed that of rayon filament. The relative importance of the production of the former in various countries is reflected in the following table:—

Production of Rayon Staple Fibre.
(In million lb. during 1940.)

Brazil	1·3
Finland	0·6
Germany*	575·0
Great Britain	50·0
Italy	225·0
Japan	300·0
Sweden	3·9
United States of America	81·0

Wool.

Raw wool is produced under a very wide range of conditions which vary from season to season and year to year. As it will never be possible to produce a uniform product, wool will always require a great deal of handling and manipulation by skilled workmen and intricate machines throughout the process of manufacture. On the other hand, synthetic fibres are produced in a factory under standard and perfectly controlled conditions.

The special features of wool as a textile fibre depend upon fineness, length, crimp, strength (tensile), extensibility, and elasticity. Wool is the most suitable fibre for use in fabrics as outer or underwear. It has unsurpassed qualities for giving warmth and for the the absorption of moisture for wear, and its elasticity gives comfort and ability to recover its shape. Wool has, in fact, the best combination of qualities of all textile fibres.

* Includes production in Austria (?), Belgium (2·5), Czechoslovakia (0·7), France (15·5), Poland (9·0). The figures in brackets indicating the production in 1939.

Synthetic Fibres.

The improvement and large-scale production of synthetic fibres has been accelerated during the past decade in America, Germany, Italy, and Japan, where the supply of natural fibres has been inadequate for the demands of the industry. These countries have reduced their importations of textile materials, and during the war period, most manufacturing countries have been endeavouring to establish greater selfsufficiency in their textile industries.

Wood pulp, whose main constituent is cellulose, forms the raw material for viscose rayon, which is the most important synthetic textile material produced. Staple fibre is identical in composition to filment rayon, both being produced by the viscose process, but the former is cut into short lengths which are used for substituting natural fibres. There are many types of synthetic fibres which are made by chemical processes from wood pulp; rayon types differ in fineness, lustre, denier (thickness of threads), etc. The most recent remarkably successful addition to the long list of synthetic fibres is Nylon, which is a coal product, also produced by a chemical process. This process has been developed on a very large scale in the United States of America. It was estimated that the annual production of Nylon would expand to 20 million lb. by the end of 1942.

Apart from its use for the manufacture of pure synthetic fabrics, the improved synthetic textile fibres can be used in blends with any of the above-mentioned natural fibres. Most synthetic fibres are suitable for replacement of cotton, but rayon staple fibre is particuularly suitable for blending with various types of wool.

Staple fibre requires no purification before spinning, hence production costs are lower than those of natural fibres and there is less chance of deterioration; also it is uniform in all its properties and length.

The above clearly shows that synthetic fibres play a very important rôle in the textile industry and that they are destined to play an even greater part if their qualities are satisfactory. Any fibre holding its own on world markets, must comply with textile requirements and its qualities must be equal to or exceed those of other competitive fibres.

Promotion of Wool as a Textile.

The present threat to wool is by no means alarming, but it would be foolish to under-estimate the danger of substitution. The need for the promotion of wool has been realised for some years. During the past number of years, especially, new avenues of research have been planned and a great deal of work undertaken to explore every aspect of wool production.

Closely associated with the manufacturing aspect, studies of the physical and chemical properties and the " inherent and circumstantial disadvantages " of wool are being made. Methods on being studied for the removal of wool's susceptibility to moth attack, its prickiness, shrinkage through laxation and felting. Other researches have been planned to establish a clearer conception of wool quality, to study its molecular structuure by X-ray, and to ascertain by microscopic examination the effects of the manufacturing processes and chemical treatments on the wool fibre.

The wool producer's contribution to the building up of that section of the textile industry which will demand his product, is important because the welfare of the wool grower will depend entirely upon the amount of wool, that will be required in the pure or mixed form. Programmes of research have been planned to study

the problems of the sheep farmer and numerous projects are in progress to study wool growth, and the many factors influencing yield, quality, colour, etc. The greater part of the sheep country of the Union being particularly suitable for the production of fine wool, research work is focussing much attention upon merino sheep. The differences of wool characteristics of different types of merinos (the developed versus the plain) are being studied on a large scale. The adverse effects of mal-nutrition, external parasites and disease are being demonstrated. This work receives liberal financial support from the South African Wool Council, which body, in conjunction with Australia and New Zealand, established the International Wool Secretariat with headquarters in London.

There is no doubt that the market organization is an equally important aspect of the woollen textile industry. However, it is not intended to discuss this matter here, but it is desired to stress the need for a modification of the methods of the past in order to facilitate the sale of wool on established standards which will ensure a fair reward to the farmer for his contribution in production. No figures of comparative cost of production of the important textile fibres are, according to the knowledge of the author, available: information of this kind would be most interesting and valuable.

Economists and specialists on international industrial development are most active in formulating plans for post-war reconstruction. All industries are involved, and the textile industry will have to receive considerable attention. The general conception of a fair distribution of human needs appears to be uppermost in the minds of those who are planning policies of full employment and social security. An Australian authority has expressed himself as follows: "What we want is not merely better machinery and certainly not more shrewd deals, but some way of bridging the gap between plenty and poverty." . . . . "agriculture should not be called upon to meet the supreme needs of nations during wars and then be allowed to fall into a slump between times." Also: ". . . . there must be a regulation of supply so that a reasonable price level can be maintained . . . ." It is considered that in order to accomplish these ideals, international co-operation is absolutely essential. In an address at the International Labour Conference held in New York, in November, 1941, President Roosevelt was reported to have said: "There are so many millions of people in this world that have never been properly fed, clothed, and housed. By undertaking to provide a decent standard of living for these millions, the free peoples of the world can furnish employment for every man and woman who seeks a job." The improvement of the standard of living of the large masses of several immense continents is of paramount importance to the textile industry and especially to the wool industry. The smallest degree of improvement will immediately result in increased consumption of clothing and other protective materials. These people are likely to require hard-wearing and long-lasting materials and no better can be made than from wool.

The following recommendations for the reconstruction of industries and especially agriculture were made by an Australian authority:—

(1) Orderly marketing of all products should be supervised by Control Boards.

(2) Countries should develop their own markets and build up a balanced economy.

(3) Farmers should grow more for their own use. Wherever possible they should undertake diversified farming and select the

most suitable combination of farm enterprises for their particular area. However, there are large tracts of country suited for certain types of farming only.

Proposals for the Future.

Wool will continue to be the premier agricultural product of the Union of South Africa.

The following brief outline indicates the more important directions in which, it is considered, activity should be directed in order to further research in connection with production problems and to ensure that the application of that knowledge to sheep husbandry.

(1) Research should be continued along the lines at present followed in this and other countries.

(2) Surveys throughout all districts, in which sheep are kept under extensive conditions or under diversified farming conditions, would reveal valuable information upon the suitability of types of sheep for different environmental conditions. This applies especially to non-wooled versus wooled sheep, and particularly the Merino, of which certain types will, undoubtedly, be found to be more productive under a certain set of conditions.

(3) Farmers should employ every effort to conserve their veld by guarding against over-grazing and by employing methods which experience has found to be the best for the particular area and type of pasture. These problems are receiving the attention of the Department of Agriculture and Forestry at numerous centres throughout the country.

(4) As the death-rate in most districts is remarkably high, the protective and curative measures, advocated by the Department, must be applied in good time. Internal parasites are still the cause of many deaths of sheep and lambs. Reduced wool yields result from sheep which survive such infestations.

The blowfly has become a menace in many parts of the country. Research workers are investigating various aspects of the problem. Breeders are urged to breed a type of sheep (devoid of crutch wrinkles) which is less susceptible to fly strike.

Deficiency diseases occur to a marked degree in certain parts of the country where the pasture is poor or where severe winters and prolonged droughts are experienced. It is important to ascertain whether the feeding of supplementary rations (feeds and/or licks) can be practised economically.

(5) As the fertility of sheep is low, this aspect requires the closest attention of all concerned. Merino flock and stud lambing percentages are frequently as low as 40 and 50 per cent. Such low fertility adversely affects annual sheep increases, rate of improvement by selection, and, of course, ultimately, the net income.

Most of the causes of infertility have been found not to be due to pathological conditions, but to abnormal and irregular physiological states, many of which can be overcome by methods of management. Extensive experiments have proved the importance of both the ram and the ewe in problems of infertility.

More drastic measures should be taken by stud and flock owners to encourage greater reproductive capacity in rams and ewes. The characteristic is inherent and selection can, therefore, be used to establish a high degree of fertility.

(6) Many studs and flocks throughout the country exhibit conformational defects, which at times seriously affect body-form and symmetry. These defects not only weaken merinos as wool-

bearing sheep, but also detract considerably from the value of their carcasses. The latter warrants attention because many thousands of merinos find their way to the abattoirs. Narrow chests and drooping rumps are serious defects. Australian evidence indicates that sheep with better conformation are less susceptible to blowfly strike.

Annual sheep classing should eliminate undesirable individuals, due attention being given to sheep which show undesirable wool characteristics, or which are below the average standard of the stud or flock.

(7) Greater attention must be given to proper wool classing as many advantages are derived therefrom. The adoption of definite standards by the British Wool Commission is evidence of the need for standardization. There should be no relaxation of these standards and it may even be possible to devise methods which would establish the standards used more accurately by a system of sampling and rapid analysis.

Farmers are urged to class their wool clips annually according to the standards of the National Wool Growers Association of South Africa. It will be found that wool classing will assist sheep classing to a great extent; sheep with inferior fleeces should be marked and culled.

Future Well Guarded.

Wool can no longer rely upon its traditional virtues to maintain its reputation as a textile fibre. Because wool has the best combination of qualities of all textile fibres, its future is well guarded. But it will maintain its position in the textile world only if the full resources of science are employed in its interests.

It is thought that wool's greatest promotion in textile usage is likely to be brought about when the masses of people, who have never been properly clothed, are able to purchase adequate clothing.

It seems unlikely that drastic permanent changes will occur in the near future. In the meantime wool growers should endeavour to reduce their cost of production by eliminating unnecessary losses and adopting improved methods.

Some Hints on Poultry Farming.

Preventing draughts in fowl-houses.—One of the chief causes of colds and roup in poultry is a draughty fowl-house. The roof should fit closely on the side walls. An opening of 3 to 4 inches must be left between the whole length of the back wall and the roof. To prevent side draughts in a long house, there should be a solid division every 25 feet from back to front, fitting the roof closely. Of great importance is the provision of ventilation below the perches, at intervals of 5 to 6 feet, an air-brick or similar substitute should be placed in the back wall, 6 inches from the floor. Outside a baffle plate (a piece of wood or flat iron) is placed over the air-brick, leaning against the wall, 6 inches above the top of the air-brick, projecting 6 inches on either side and resting on the ground 6 inches from the wall.

[E. F. Lombard, Professional Officer (Poultry), East London.]

A Scoop for use in Compost-making.

J. D. Scott, Officer in Charge, Estcourt and Tabamhlope Research Stations, Division of Soil and Veld Conservation.

IN the making of compost at the Estcourt and Tabamhlope stations, all dry stock are fed in kraals during the winter to afford them maximum protection against cold. A fresh layer of bedding is added to the kraals each week or whenever required until, by the end of the winter, a mixture of grass, dung and urine to a depth of a couple of

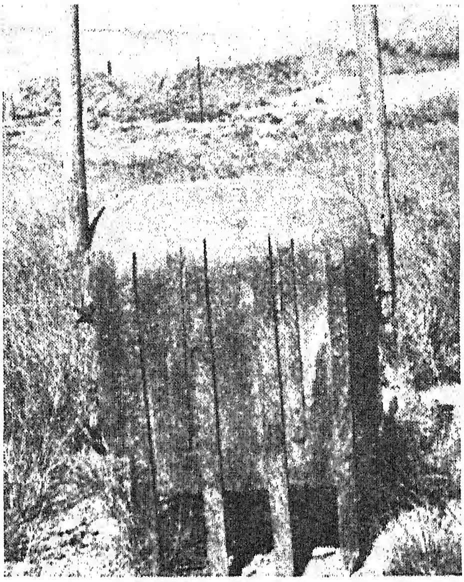

FIG. 1.—View of underside of scoop, showing how the iron bars are riveted on.

feet is obtained. This is not touched during the winter as temperatures are too low and there is not enough moisture for much bacterial action.

At the end of the winter the cattle return to the veld and, after the bedding in the kraals has been wetted thoroughly by rain, it is built up into heaps about 4½ feet high varying in width from 12 to 18 feet and in length from 25 to 60 feet. The removal of the material from the floor of the kraal has always been an expensive process. Turning by means of a plough has resulted in continual packing in front of the plough, and a dam scoop has always jumped. As a result the material has had to be removed by hand labour with forks and wheelbarrows which is slow and expensive.

An improvement to a dam scoop was therefore tried out with excellent results. Four iron bands 2 inches wide and ½ inch thick, sharpened to a point, were riveted under a dam scoop so that the two middle ones projected about 11¾ inches and the two outer ones 10 inches in front of the scoop, being just clear of the inside of the draw-bar. In addition to the rivets, the front edge of the scoop was welded to the bars so that there was no chance of material working between the bars and the scoop.

These sharpened bars penetrated the mixture on the kraal floor easily and it was possible for two boys to remove all the material,

with two oxen drawing the dam scoop. As the passage of the oxen over a heap would have consolidated it too much, the compost material was dumped outside the kraal where two other boys packed it into the heaps.

This improved implement has cut down the cost of compost-making at Estcourt enormously. Two boys with two big oxen in this

FIG. 2.—View of scoop from above, showing the position of the bars in relation to the draw-bar. Note welding of edge of scoop to the bars.

scoop took the compost material out of the kraal at the rate of just under 19 tons per day (1 cu. yd at 70 per cent. moisture weighs approximately $\frac{1}{2}$ ton) and, with two boys packing it into heaps, it was possible to build a stack 25 ft. × 18 ft. × $4\frac{1}{2}$ ft. high in two days.

The cost of affecting these improvements to the scoop (at the present high price of iron) is only a matter of about £2. 10s. and this amount is easily saved in labour within the first few days. The bands riveted underneath act as shoes, taking all the wear and thus adding considerably to the life of the scoop.

The Feeding Requirements of Laying Hens.

A. M. Gericke, Department of Poultry Breeding, Agricultural Research Institute.

THE number of eggs a hen can produce is determined by heredity, environmental factors, as well as by the quantity and quality of feed she consumes. Normally, a hen is sexually mature at 6 months of age, but body-maturity is only attained at approximately 10 months of age. In her development, feeding is essential for maintenance, growth requirements, egg production, and for physiological work in egg laying. After a hen has attained body maturity, the feeds are required mainly for maintenance and egg production. The maintenance requirement is described by Dr. Titus as the minimum amount of the various foods required to sustain the essential body processes at an optimum rate without gain or loss in body weight or change in body composition, exclusive of the food used in growth or expended in work or other productive functions. The economic maintenance requirements of two different breeds of pullets of different body weights given by Titus (1940) are as follows:—

Breed.	*Weight.*	*Per Day per Pullet.*
White Leghorn....................	4·0 lb.	2·32 to 2·56 oz.
White Leghorn....................	3·6 lb.	2·144 to 2·368 oz.
Rhode Island Red.................	5·5 lb.	3·28 to 3·632 oz.
Rhode Island Red.................	5·0 lb.	2·976 to 3·296 oz.

According to these figures it is quite clear that the economic maintenance requirements of heavy breeds are definitely greater than that of light breeds. After growth and maintenance requirements have been met, the quantity of feed required to produce a two-oz. egg is between 1·248 ozs. to 1·6 ozs., or an average of 1·424 ozs. A leghorn pullet of an average body weight of 4 lb. will, therefore, consume approximately 3·864 ozs. of feed per day for maintenance and the production of a two-ounce egg, while a 5 lb. Rhode Island Red pullet will consume approximately 4·56 ozs. of feed per day for maintenance and the production of a two-ounce egg.

Daily Consumption.

If 100 White Leghorn hens, with an average body-weight of 4 lb., are laying at the rate of 50 two-ounce eggs a day, they will consume approximately 19 lb. 11 ozs. of mixed feed a day. In this case 4·69 lb. of feed are required for the production of a dozen eggs. If 100 Rhode Island Red hens, with an average body-weight of 5 lb. per bird, are laying at the rate of 50 two-ounce eggs a day, they will consume approximately 24·05 lb. of feed daily. In this case 4·69 lb. of feed are required for the production of a dozen eggs. If 100 Rhode Island Red hens, with an average body-weight of 5 lb. per bird, are laying at the rate of 50 two-ounce eggs a day, they will consume approximately 24·05 lb. of feed daily. In this case 5·77 lb. of feed are required for the production of a dozen eggs. According to these figures a Leghorn hen, laying 15 dozen eggs per year, will consume approximately 70 lb. of feed per annum, whereas a Rhode Island Red hen will consume approximately 87 lb. of feed per annum. Normally, the annual feed requirements for light breeds are estimated at 70 to 85 lb. per bird, and for heavy breeds at 85 to 95 lb. per bird. The estimated allowance of feed is, therefore, higher than that given for maintenance and egg production.

The reasons for this increase are that certain strains or families within the same breed are often more efficient utilizers of feed than others. In addition, feeds are also required for important physiological work, such as the formation of eggs.

A 100 light-breed hens should receive about 10 lb. of laying mash and 10 lb. of scratch grain daily, whereas a 100 heavy-breed hens require about 12 lb. of laying mash and 12 lb. of scratch grain daily. The method of rationing scratch grain, however, greatly influences the consumption of laying mash. If 100 hens receive only 5 lb. of grain per day, they will consume about 15 lb. of laying mash daily, whereas if they receive 10 lb. of grain daily, they will consume about 10 lb. of laying mash daily. In the winter season, hens invariably consume more scratch grain than laying mash, whereas in the spring more laying mash than grain is consumed. As the consumption of laying mash stimulates egg production, hens should be encouraged to consume sufficient mash, especially during the winter and autumn months. In addition to the dry laying mash, the feeding of wet mash in the morning seems to encourage the consumption of mash during the winter months.

Economical Feeding.

The quantity of feed required for the production of an egg is always much less than that required for maintenance. The feed cost is, therefore, much less for a high producer than for a low producer. From the results obtained at the University of Maryland, U.S.A., a White Leghorn hen will consume between 7·7 and 8·7 lb. of feed per dozen eggs if she lays 100 eggs annually, but only 4·4 to 4·9 lb. of feed per dozen eggs if she lays 200 eggs annually. The amount of feed required to produce a dozen eggs is also influenced by the size of eggs produced. At Grootfontein 51 White Leghorn hens, with an average production of 171 eggs and an average egg-weight of $2^1/_{16}$-ounce eggs in 365 days, required 6·47 lb. of feed to produce a dozen eggs.

For economical feeding it is essential that the cereal and animal by-products used in poultry feeding should be of good quality. The cereal by-products are low in proteins, minerals and vitamins. For optimum results, these products must be supplemented with animal and/or vegetable proteins, calcium, phosphorus, sodium, manganese and the essential vitamins A, B_1, D, K, riboflavin and pantothenic-acid. A two-ounce egg contains about 7 grams or $\frac{1}{4}$ oz. of protein. According to Titus, a hen must receive from 10·5 to 12·5 grams of digestible protein to produce such an egg. To supply this, 12·5 to 15 grams of feed protein of good quality are required. Proteins in the body are constantly undergoing destruction, and unless proteins are supplied in the ration daily, the hen cannot live. In the case of the light Sussex breed, Halnan (1939) found that the daily digestible protein requirement for maintenance per pound of live weight was 0·625 grams and 12·5 grams for the production of a two-ounce egg. For a heavy breed hen, weighing 5 lb., the daily digestible protein requirement for maintenance and the production of a two-ounce egg may be as high as 15·625 grams. How to meet this demand in the ration, is an important question. It is generally accepted that the ration of laying hens should contain from 15 to 17 per cent. of crude protein for maintenance and egg production. To determine this amount it is necessary to use a feeding standard.

Selection of Ingredients.

In the selection of the ingredients which are necessary in a laying ration, it is important to know how one ingredient can best

be utilized to supplement the other. For this purpose a chemical analysis is essential. Additional information in regard to the digestibility, cost, and the influence of ingredients on health and egg production is of great assistance in computing the ration and will give more reliable results.

In Table I the average composition of foodstuffs is given and in Table II the ration has been computed.

TABLE I.—*Average Composition of Foodstuffs.*

Percentage.	Crude Fibre.	Crude Fat.	Crude Protein.	Calcium.	Phosphorus.
Yellow mealies	2·3	5·2	9·6	0·02	0·24
Yellow mealie meal	2·2	4·6	9·64	0·02	0·24
Maize germ meal	11·5	7·8	13·5	0·04	0·58
Wheat	2·5	2·0	11·0	0·03	0·42
Wheat bran	9·95	3·2	15·5	0·14	1·04
Pollard	7·2	3·5	16·5	0·09	0·75
Ground oats	10·3	7·2	9·8	0·112	0·382
Ground barley	5·8	1·9	9·0	0·06	0·35
Lucerne meal	27·0	2·6	16·5	1·25	0·19
Meat and bone meal*	2·2	9·0	55·0	10·43	5·3
Fish meal (white)	—	3·0	65·5	6·0	3·3
Peanut meal	9·0	8·2	42·5	0·18	0·56
Soybean meal (baked)	4·3	5·7	42·0	0·24	0·68
Bone meal	3·3	3·0	20·6	22·5	11·2
Oyster shell	—	—	—	38·0	0·6

* As meat meal normally contains a fair amount of bone meal, the term "meat and bone meal" has been used in preference to "meat meal".

TABLE II.—*Composition of Laying Ration by Calculation.*

Ingredients. (lb.).		Crude Fibre.	Crude Protein.	Calcium.	Phosphorus.
30	yellow mealie meal	0·66	2·892	0·006	0·072
10	maize germ meal	1·15	1·350	0·004	0·058
10	wheat bran	0·99	1·550	0·014	0·104
15	ground oats	1·54	1·470	0·017	0·057
10	lucerne meal	2·70	1·650	0·125	0·019
10	meat and bone meal	0·22	5·50	1·043	0·530
10	fish meal	—	6·550	0·600	0·330
8	peanut meal	0·72	3·40	0·014	0·045
1½	bone meal	0·05	0·309	0·337	0·168
3½	oystershell powder	—	—	1·330	0·021
1	fine salt	—	—	—	—
109	mash	8·03	24·671	3·490	1·404
100	mash	7·37	22·64	3·20	1·30
100	yellow mealies (grain)	2·30	9·60	0·02	0·24
200	ration	9·67	32·24	3·22	1·54
100	ration	4·83	16·12	1·61	0·77

It will be noticed that 100 lb. of laying mash contain 7·37 lb. fibre, 22·64 lb. protein, 3·2 lb. calcium and 1·3 lb. phosphorus. This mash cannot be fed alone, as the protein and minerals are too high. When equal quantities of laying mash and grain are fed, then the ration is balanced correctly. In most laying rations about 15 per cent. of protein, 1·5 to 1·6 per cent. of calcium and 0·75 per cent. of phosphorus are fed. For average producing flocks 16 per cent. protein may be unnecessarily high. The meat and bone meal, fish meal and peanut meal can, therefore, be reduced by 1 lb. each. For egg production more than 1·61 lb. calcium is required, and oyster shell (in separate hoppers) has to be provided for the hens. The hen is then allowed to balance her own calcium requirements.

Correct Quantities and Ratio.

If grain feeding is omitted and 100 lb. of yellow mealiemeal are added to 100 lb. of the laying mash (Table II), then the ration is described as an all-mash laying ration. It is customary to feed 2 per cent. calcium and 0·75 per cent phosphorus in most all-mash rations. If this quantity of calcium is supplied in the ration, it may be a dangerous practice to provide oystershell for the hens in separate hoppers. An excess of calcium and bone meal will lower the biological value of a ration by removing manganese from the intestinal contents and making it unavailable to the fowl. Schaible and Bandemer (1942) reported that rations with an excess of calcium and phosphorus behave like manganese-deficient rations. Wilgus and co-workers (1937) found that rations containing too little manganese or an excess of calcium and phosphorus produce perosis, lower egg production and hatchability, and give poor shell structure. These are some of the reasons why the correct quantities as well as the proper ratio between calcium and phosphorus are of such great importance in making up a ration.

There is no doubt that the calcium required by laying hens is very high. Titus states that a hen, laying 200 eggs per annum, supplies about 400 grams of calcium in these eggs, which is from 13 to 15 times as much as she has in her entire body. According to Halnan (1925), a hen fed on wheat alone must consume nearly 12 lb. of wheat to supply enough calcium for one egg. The correct amount of calcium to be supplied in the ration is dependent upon the quantity of feed consumed, the number of eggs produced per hen and the phosphorus content of the ration.

Osyter shell and limestone powder are good sources of calcium, while bone meal is a good source of phosphorus. Good quality limestone powder should be low in magnesium. If a ration contains limestone powder, with a magnesium content in excess of 4 or 5 per cent., the magnesium will have an antagonistic influence towards calcium, with the result that the calcium will be discharged from the body in excessive quantities.

To give the reader an idea of the amount of oyster shell or limestone powder and bone meal which should be included in the laying mash, the ingredients present in mash rations fed in pre-war days and those fed under present day conditions, are given in Table III. The analyses of the rations, i.e., when equal quantities of mash and grain are fed, are presented in Table IV.

TABLE III.—*Laying-mash Formulas (in lb.) to be fed with equal quantities of Scratch Grain.*

Ingredients.	No. 1.	No. 2.	No. 3.	No. 4.
Yellow mealie-meal	20	45	45	—
Maize germ meal	—	10	10	10
Wheat bran	30	—	—	25
Pollard	20	—	—	—
Ground oats	10	10	10	—
Lucerne meal	5	10	10	10
Ground barley	—	—	—	35
Meat and bone meal	16	13	—	18
Fish meal	—	—	13	—
Baked soybean meal	—	13	12	—
Peanut meal	8	—	—	10
Bone meal	—	3	4½	—
Oystershell powder	4½	3	4	4
Fine salt	1	1	1	1

TABLE IV.—*Analyses of Rations.*

	No. 1.	No. 2.	No. 3.	No. 4.
Crude protein..........................	15·2	14·80	15·20	15·05
Calcium................................	1·55	1·56	1·61	1·61
Phosphorus.............................	0·75	0·75	0·69	0·77

Wheat bran is much higher in phosphorus than any other cereal by-products. If the ration contains wheat bran and meat and bone meal, no extra bone meal need be included in the mash. If a ration contains a high percentage of mealiemeal and peanut or soybean meal, then the inclusion of bone meal is essential.

To meet the manganese requirements of laying hens, about ½ lb. of manganese sulphate should be added to one ton of food. Oat hulls are an excellent source of manganese. In the absence of manganese sulphate, it will be found advantageous to include ground oats in the ration. For poultry feeding, the whole grain must be ground to a fine meal and the hulls should not be removed in the milling process. Whole oats can be used to great advantage as a grain feed, especially if mixed with other grains.

Sufficient sodium is supplied by the addition of ½ to 1 per cent. of fine dairy salt to the laying mash.

Vitamins.

When laying hens run outside and have access to green range and sunshine, no provision need be made for an extra supply of vitamins. During the winter months, however, green feed is lacking on most farms and provision must be made for a sufficient supply of vitamin A. An insufficient amount of vitamin A lowers the resistance of hens to disease, development is retarded, they appear unthrifty and nutritional roup (Avitaminosis A) may occur. Fish-liver oils, yellow mealies and green food are good sources of vitamin A. In most poultry rations, where laying mash and grain are fed, yellow mealies represent about 50 to 60 per cent. of the ration. The mealies will supply approximately 50 to 60 per cent. of the vitamin A requirements of a laying hen. The deficiency in vitamin A has to be met by green feed, lucerne meal or fish-liver oils. When equal quantities of laying mash and grain are fed about 5,000 international units of vitamin A per lb. of feed will meet the vitamin A requirements of a hen. Seven per cent. of good quality lucerne meal, containing 10 milligrams of carotene per 100 grams, contains 5,300 units of vitamin A per lb. of feed. If this percentage of lucerne meal is included in the mash, more than sufficient vitamin A will be supplied in the ration. If lucerne meal or green feed is not available, then ½ per cent. of fish-liver oil should be mixed with the laying mash. The feeding of poor quality lucerne meal in the absence of green feed may result in avitaminosis A.

Rations deficient in vitamin B1 (thiamin) cause a form of paralysis, especially in young stock. When this vitamin is lacking in the ration, it will be found that the birds cannot use their legs and wings for normal movement. A hen requires 180 international units of thiamin per lb. of food for egg production. More than this amount is commonly found in the cereal grains supplied in the ration.

Vitamin D is necessary for the assimilation of calcium and phosphorus. If hens receive direct sunshine for about ½ to 1 hour per day more than sufficient vitamin D is supplied. On the other

hand, if hens are kept intensively or do not receive direct sunlight, the mash should be fortified to contain 700 international units of vitamin D per lb. of food. To supply this requirement, 2 per cent of fish-oil, containing 85 international units of vitamin D, should be fed. An urgent warning is given to poultry farmers not to feed this laying ration to chicks. When an all-mash ration is fed to chicks, only ½ per cent. of fish-oil will meet their vitamin D requirements, that is, 177 international units of vitamin D per lb. of mash. If both mash and grain are fed then 1 per cent. of fish oil should be mixed with the chick mash.

In the absence of green feed, wheat-bran and pollard chick rations may be low in vitamin E (alfa-tocopherol). This vitamin is essential for good fertility in poultry. In chicks this vitamin prevents a deficiency disease known as encephalomalacia. The symptoms of this disease are muscular inco-ordination with a tendency for the chick to fall backwards, accompanied by twisting of the head and spasms of the legs. The symptoms develop suddenly and in most cases death follows. It is possible that this deficiency disease may also develop in chicks which are fed rations adequate in vitamin E. Hammond (1941) gave proof that there is a factor in cod-liver oil that hinders the utilization of vitamin E by chicks. This applied to experimental rations in which excessive amounts of cod liver oil (3 per cent.) were fed. In experiments conducted by Sanders (1942) at the Agricultural Research Institute, 52·8 per cent. of the chicks fed on an all-mash ration consisting of 40 lb. yellow mealiemeal, 10 lb. fermented mealiemeal, 15 lb. oatmeal, 10 lb. lucerne meal, 13½ lb. fish meal, 1 lb. oystershell powder and ¼ lb. fish liver oil, died from encephalomalacia or crazy chick disease. He came to the conclusion that the feeding of fish meal in a ration, containing no wheat by-products or which is low in vitamin E, may be a dangerous practice. Wheat-germ oil, soybean oil and peanut oil are concentrated sources of vitamin E, while sprouted oats and green feed are good sources. It seems that at least one-third or possibly one-half of the fish-meal protein in the ration should be replaced by baked soybean meal or peanut meal in order to ensure that sufficient vitamin E will be present. In the absence of cereal oils, wheat by-products and green feed rations containing 40 to 50 per cent. of yellow mealiemeal should be supplemented with baked soybean meal or peanut meal and maize-germ meal to increase the vitamin E potency of the ration.

For egg production, laying hens require 680 micro-grams or Cornell chick-units of riboflavin per lb. of feed. If eggs are used for hatching, 1,250 micro-grams of riboflavin should be supplied per lb. of feed. Green feed is a good source of riboflavin for laying hens. As the riboflavin requirements for chicks and breeding hens are much higher than that of laying hens, their rations should be supplemented with foods rich in riboflavin, such as dried brewers' yeast and dried milk products. Since these products are scarce and expensive in the Union, poultry farmers will have to use fresh green feed and liquid skim milk to meet the shortage of this vitamin. It may be emphasized that these foodstuffs are of much value in poultry feeding because they are also potent sources of other vitamins. The growth-promoting function of riboflavin in young animals has been shown in numerous experiments with chicks and mammals. As dried brewers' yeast and dried milk are such excellent sources of riboflavin, these foodstuffs are of very great importance to the poultry industry, and their production should be encouraged as much as possible.

It is seldom that laying rations are deficient in pantothenic acid or the chick-dermatitis vitamin. Brewers' yeast, sugarcane molasses

and lucerne meal are all good sources of this vitamin. Cane molasses, however, is a poor source of riboflavin. Vitamin K, or the vitamin which prevents excessive bleeding from a small wound, can best be supplied by adding as little as $2\frac{1}{2}$ to 3 per cent. of good quality lucerne meal to the ration.

At the Agricultural Research Institute, the ration given in Table II gave good results in the production of eggs. It is, however, not claimed that this is the best ration for the Union. The cost as well as the availability of ingredients are two important factors which had to be considered in computing this ration. The writer trusts that it may prove to be of value to poultry farmers.

Selection of Substitutes.

As a result of the severe drought which prevailed in the summer 1941-42, it is difficult at present to procure the various foodstuffs necessary in laying mashes. The two principal grains, viz., mealies and wheat and their by-products, have accordingly been greatly reduced in laying mashes and it has become necessary to replace them by other foodstuffs. These substitutes have in turn been used on such a large scale that they have also become scarce. In order to guide poultry farmers in the selection of substitutes, it is suggested that barley meal or kaffir corn, if available, could be used to replace all the mealiemeal in the laying mash ration as given in Table III, while wheat bran can be omitted by increasing maize-germ meal and ground oats by 5 lb. each. Furthermore, peanut meal can be replaced by baked soybean meal on an equal basis. If peanut and soybean meal are not available, cowpea or ordinary bean meal may be used to replace them in the ration. In addition rye, boiled potatoes, buckwheat and wheat are possible carbohydrate substitutes. While possibilities of substituting the foods exist, it is difficult to say whether they will be available in sufficient quantities.

An important factor which all poultry farmers have to consider very seriously is the culling of flocks. As low egg producers are such poor utilizers of feed, culling should be drastically applied. By keeping culls in the flock so much food is wasted that little will remain for the efficient egg producing hens. According to the Census (1937) there were approximately 12,000,000 head of poultry in the Union. Assuming that this number is still kept and that 50 per cent. are hens and 10 per cent. of these hens are culls, then the feeding of the culls would result in a wastage of 58·8 tons of feed per day. This figure is based on a consumption of 3·136 ozs. of food per bird per day for maintenance requirements. Drastic culling of hens will, therefore, be in the interest of the poultry farmer when he is striving towards economical production.

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Loss of Weight in Broody Hens:—

[Continued from page ...

than is allowed by the regulations of the egg-laying competition. There was even one case of a hen which gained two pounds in weight. It is very obvious, therefore, that the weight of a hen which has experienced a period of broodiness may vary very widely at different times, namely, at the end of the competition, at the commencement of the competition and on her return to the owner.

The reason for the increase in weight must be sought partly in the condition of the ovary. Only hens in good condition become broody. A hen stops laying before becoming broody, i.e., the egg-cluster passes through a period of rest. As soon as the egg-cluster stops functioning it shrinks and loses weight. When it begins to function again a number of yolks begin to develop simultaneously, the process being accompanied by an increase in weight. It is even asserted that there is an increase in the amount of blood in the hen.

The following figures show the fluctuation in the weights of different breeds:—

Breed.	All Breeds.	Australorps.	Rhode Island Reds.	Light Sussex.
Average weight when placed in broody pen..................	5·06 lb.	5·25 lb.	4·97 lb.	4·97 lb.
Average weight at first egg after broody period................	5·72 lb.	5·86 lb.	5·78 lb.	5·49 lb.
Average number of days from last egg to first egg after broody period.......................	19·85	20·61	19·89	19·67
Average increase in weight.....	0·66 lb.	0·61 lb.	0·82 lb.	0·57 lb.
Maximum increase in weight....	+ 2·00 lb.	+ 1·62 lb.	+ 1·43 lb.	+ 2·00 lb.
Minimum increase in weight......	— 0·5 lb.	— 0·06 lb.	— 0·31 lb.	0·5 lb.

Useful Hints for Poultrymen.

Sacking makes servicable walls for poultry houses. Old grain bags are cut open along the seams and nailed tightly on to the outside framework, with clout nails, and the joints neatly sewn together. When complete, the sacking is thoroughly soaked with water and the following mixture applied with a brush, giving one coat on the inside and two or more on the outside.

Mixture: Water $1\frac{1}{4}$ gallons; cement 12 lb.; lime 2 lb.; salt 1 lb.; alum $\frac{1}{2}$ lb. Sieve the lime and salt to break up lumps, add the water then the cement, stirring while adding, add the alum last. Select a dry, cloudy day for the application of the mixture. The second and subsequent coats must be applied when the former is wind-dry. It is known that such houses have given good service for a number of years. This material is also satisfactory when used on pitched roofs.

[E. F. Lombard, Prof. Officer (Poultry), East London.]

A Popular Bulletin for the Farmer.

Bulletin 234.—"-Re-inforced Circular Reservoirs." Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria, at 3d. per copy.

Growing of Culinary Herbs.

H. B. Terry, Division of Horticulture.

TO the housewives of the past generation, before the days of community flats, the most interesting part of the garden was that portion which was devoted to the growing of herbs and fragrant-leaved plants. Whilst the use of culinary herbs are not unknown and their culture presents few difficulties and they require little space, the general modern tendency is to depend upon a few dried kinds obtainable in tins. In a garden, even where the spacing of most vegetables or flowers has to be economically planned, the growing of culinary herbs as an edging or as border plants will supply the housewife with a variety of flavourings and garnishings whereby the quality, flavour, and piquancy of the humblest dish will be enhanced.

Parsley is perhaps the most extensively used of all culinary herbs. The ornamental nature of the foliage makes it an excellent edging plant in any situation. The plant will grow in almost any type of soil, provided it is not of too stiff a nature so as to become waterlogged. To maintain a supply throughout the year, at least two sowings should be made, viz., in August or September and again in February. The soil should be deeply dug, limed, and enriched with well-rotted manure or compost well ahead of sowing. The seed should be sown in shallow drills where the plants are to grow, and the seedlings thinned out later to six inches apart. Its food-value in salads and for garnishing justifies its place in every garden. The variety Triple Curled, is one of the most satisfactory from a decorative and utility point of view.

Thyme grows best in a well-drained loam soil. It is not necessary to apply much old manure, since the plant is inclined to spread. *Thyme* may be grown from seed but quicker results are obtained from division of old plants or those purchased from a nursery. The plant should not be allowed to flower as this weakens it. As soon as the buds appear, cut the whole growth back. New growths will soon develop for use.

Lemon Thyme is also worthy of a place in the garden, as it possesses a distinct flavour from the ordinary Thyme, and its yellow marked leaves give it a distinctive decorative value. Lemon Thyme is increased by cuttings or root division of the parent plant during early Spring.

Sage is a perennial evergreen plant with an almost woody stem. The plants develop into compact bushes 12 to 15 inches in height and ive in a rather dry stony, or limestone formation. While suffi- itly hardy to withstand ordinary winter conditions, when grown wet positions, it is liable to be killed by frost. Sage is grown om seeds sown in boxes and later transplanted into their permanent uarters 12 inches apart. It is also possible to increase Sage by emoving side growths from the old plants. The plants should be cut back occasionally to stimulate new growths, as the younger and fresher the leaves the more pungent and suitable they are for seasoning. The plants should be renewed every 3 to 4 years.

Mint is undoubtedly another indispensible herb, being too well-known to need description since it is in almost daily use for flavouring potatoes, green peas, and sauce for serving with lamb or mutton. The common garden variety of mint is *Mentha viridis*, an herbaceous

perennial plant with a vigorous root system when grown in rich soil. The best method of increasing plants is by rooted cuttings taken in Spring. Usually Mint is planted near the drip of a water tap, where it soon grows out of control. In a small garden the vigour of Mint may be restricted by growing it in a 4-gallon petrol tin, or other drum, which, having been prepared by piercing a few holes, and covering these with stones for drainage, and having filled the drum with good soil, it is sunk into the ground within an inch or two of the rim.

Coriander is an important herb which is extensively grown in our home gardens as well as commercially, being largely used for flavouring Boerewors (sausage) and in the preparation of meat dishes. The plant, being an annual, seed is sown during Spring and early summer in well-prepared rather light soil; early thinning out of the seedlings is necessary as growth is rapid; the plants attain a height of about 2 feet. The round seed, which is the commercial product, is borne in profusion well above the leaves.

Chives are old-fashioned plants possessing an agreeably mild onion flavour which is unsurpassed for use in salads of all kinds. The plant develops a tuft of thin grass-like leaves which may be cut for use at any time of the year, a point which considerably enhances its value. The plants are usually grown as an edging where they appear to do better than when planted in a bed. The clumps should be lifted and divided every second year.

Marjoram or Sweet Marjoram, as it is frequently called, is used for seasoning and garnishing in many ways. The plants, which may be raised from seed or from root division during Spring or Autumn, also from cuttings during Summer, will grow in any well-drained garden soil; they should be spaced 12 to 18 inches apart. To maintain vigorous growth, the plants should be replaced once every three years.

Shallots, though botanically closely allied to the onion, differ completely in their manner of growth. The plants rarely produce seed and the bulbs, when planted in the Spring, divide and increase rapidly producing an abundance of thin green leaves, which are frequently used in salads. Shallots require a well-drained soil of moderate fertility. The plants are increased by dividing the bulbs, and planting each section separately during Autumn (March to May) in rows one foot apart, an inch deep and four inches apart in the rows.

Tarragon is a dwarf evergreen perennial plant, the leaves of which possess a delicate aromatic flavour, on which account they are extensively used for seasoning and flavouring vinegar. Plants are increased by division or root cuttings and planted fifteen inches apart in rows spaced eighteen inches apart during early Spring. The plants should not be disturbed for three to four years.

The general culture of herbs is very simple: keeping the soil loose and free of weeds, by frequent hoeing and annually working into the soil some well-rotted kraal manure and a little phosphatic fertilizer is about all that is required. A reliable water supply is necessary, and should growth at any time become too vigorous it should be cut back and dried. For the average household three to six plants of any herb will be sufficient to meet requirements.

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 AUGUST 1943 No. 252

CONTENTS

* Price Review for June, 1943.

SLAUGHTER CATTLE.—Limited supplies reached the markets, and in Durban auctioneers were most of the time compelled to divide the number of carcasses amongst buyers. Maximum prices were also realised in most cases. Prices on Johannesburg market are now being quoted on live-weight basis instead of on an estimated dressed weight on the hoof basis, as previously. The following average prices per 100 lb. live weight was realised during the month: No. 1, i.e., ordinary primes, 32s. 7d.; No. 2, i.e., good mediums, 29s. 7d.; No. 4, i.e., compounds, 23s. 1d. On the Durban market prices differed little or nothing from that of the previous month.

Slaughter Sheep.—Very small supplies were still a characteristic on the markets, and in the larger centres strict rationing had regularly to be applied in order that all buyers may get a portion. Prime merinos on the Johannesburg market averaged 11·4d. per lb. estimated dressed weight and 10·8d. per lb. on the Cape Town market.

Forage and Grain.—All kinds of forage and grains remained scarce during the month. Kaffircorn, dry beans and dry peas in most cases advanced somewhat above the previous month's high levels. Kaffircorn K_2, free on rail, in bags rose from 21s. 8d. to 22s. 1d. per bag in June, and on the Johannesburg market, speckled sugar beans rose from 41s. 6d. to 42s. 1d. per bag. Lucerne hay and teff hay experienced a strong demand and, excepting for inferior consignments, realised maximum prices in most cases. Other kinds of hay were practically unobtainable.

Potatoes.—The supply on the markets was in general smaller than during the previous months, and on the Johannesburg market National Mark potatoes especially were scarcer than usual. Consignments consisted mostly of Transvaal and Orange Free State potatoes, and prices of these rose everywhere above the previous

* All prices mentioned are average

month's level, excepting Cape potatoes on the Cape Town market, which, as a result of a larger supply and a weakening of quality, experienced a decline on this market, namely, from 15s. 6d. to 14s. 6d. per bag in the case of Cape No. 1. Transvaal No. 1 on the Johannesburg market, however, rose from 12s. 6d. to 12s. 11d. per bag in June and National Mark grade 1 Nos. 2 and 3 from 15s. 11d. and 15s. 5d. per bag to 19s. 9d. and 19s. per bag respectively.

Onions.—In spite of bigger consignments Cape onions, prices advanced further during the month as a result of the general scarcity of other vegetables. Thus Cape onions on the Johannesburg market averaged 17s. 4d. per bag in June as against 15s. 8d. per bag for May, while on the Cape Town market it was 14s. 3d. per bag as against 13s. 2d. for May.

Tomatoes.—As a result of the extraordinary severe frost in certain Transvaal Lowveld districts, consignments tomatoes from here were exceptionally small, especially at the beginning of the month. Prices as a result, on the whole advanced very sharply. National Mark Tomatoes on the Johannesburg market were 7s. 2d. per tray for June as against 4s. 10d. for May, while ordinary tomatoes rose from 2s. 6d. to 3s. 8d. per tray. On the Cape Town and Durban markets the increases were from 2s. 3d. and 2s. 6d. per tray to 4s. and 3s. 6d. respectively. Towards the end of the month somewhat bigger supplies reached the markets and a slight price decline set in.

Vegetables.—Practically all kinds were exceptionally scarce, which can also be attributed to the severe frost in some Lowveld districts. As a result, there was a general rise in price, and in some cases to exceptionally high levels. Even vegetables offered in reasonably large quantities realised higher prices than during the previous month, on account of the limited supply of other kinds. Towards the end of the month the position improved somewhat as a result of larger consignments from the Lowveld.

Fruit.—The Cape deciduous fruit season drew to a close during the month, and only small consignments cold-storage apples still come from there. Oranges were present in good quantities and were mostly of very outstanding quality. Large oranges especially experienced a sharp demand. Prices remained unchanged compared with the previous month. Pineapples and papaws increased, especially towards the end of the month, and lower prices were realised. Other tropical fruits in general were scarce and dear.

Eggs.—Supplies increased considerably during the month and prices on the whole showed a decrease on the previous month's exceptionally high levels. Fresh eggs on the Johannesburg market dropped from 3s. 5d. per dozen to 1s. 10d. for June, and new laid from 3s. 10d. to 2s. 3d. per dozen; and on the Durban market from 4s. 10d. to 2s. 9d. per dozen.

Index of Prices of Field Crops and Animal Products.

According to this index, shown elsewhere in this issue, the group "Poultry and Poultry Products" was the only one showing an appreciable decline during the month, namely, from 316 in May to 202 in June. This decrease is, of course, mainly to be attributed to the drop in prices of eggs which occurred during the month.

The most important increases occurred in the case of (i) hay, namely, from 144 for May to 165 for June, and (ii) the group "Other Field Crops" (i.e., potatoes, sweet potatoes, onions and dry beans), namely, from 155 to 165 in June.

The decline in the group, "Poultry and Poultry Products", was sharp enough, however, to cause the combined index to drop from 156 to 150 for June.

Crop Estimates—1941-42 Season.

SINCE the outbreak of the war the Departmental crop estimates are no longer published immediately after they have been made. The final crop estimates of the past season for the most important summer and winter cereals, therefore, appear hereunder for the first time:—

MEALIES (200 LB. BAGS).

(European and Native Production.)

	1940-41.	1941-42.
Cape	2,370,000	2,490,000
Natal	2,070,000	2,060,000
Transvaal	10,310,000	5,840,000
Orange Free State	9,580,000	5,950,000
Union	24,330,000	16,340,000

WHEAT (200 LB. BAGS.)

(Only production on farms of Europeans.)

	1940-41.	1941-42.
Cape	2,839,000	2,870,000
Orange Free State	1,471,000	700,000
Transvaal	539,000	550,000
Union	4,849,000	4,120,000

OTHER WINTER CEREALS.

(Only production on farms of Europeans.)

	1941-42.
Barley (150 lb. bags)	610,000
Oats (150 lb. bags)	1,230,000
Rye (200 lb. bags)	187,000

OTHER CROPS.

(Only production on farms of Europeans.)

	1940-41.	1941-42.
Kaffir Corn (200 lb. bags)	729,000	555,000
Groundnut (100 lb. bags, unshelled)		122,000
Potatoes (150 lb. bags)	2,522,000	2,427,000

Purchase and Storing of Eggs—1943 Season.

WITH a considerable increase in the local consumption of eggs as a result of war conditions, and the fact that production did not keep pace on account of the shortage of protein-rich feeds and a temporary shortage of maize, it became necessary for the Food Controller to take steps in order to provide for a sufficient supply of eggs for the season of shortage. The Food Controller has, therefore, decided to exercise full control over all cold-storage eggs. In this way the greatest possible quantity of eggs can be stored and an efficient distribution of cold-storage eggs can be assured during the coming season of scarcity. The Food Controller will also assume the sole right of purchasing, or causing to be purchased on its behalf, surplus eggs at fixed prices during the coming season of plentiful production, and of placing in cold storage or causing to be placed in cold storage such eggs which will then be made available again at fixed prices to consumers during the next season of scarcity.

All eggs offered for sale to the Food Controller must be packed in standard egg cases and must be graded for quality and size according to the published grades. At the time of purchase the eggs are subject to inspection.

The following prices will then be paid for such eggs:—

	s.	d.	
Special Grade 1, Large	1	11	per dozen.
Medium	1	9	per dozen.
Grade 1, Large	1	8	per dozen.
Medium	1	6	per dozen.

Over and above the above-mentioned prices the Controller will pay an additional amount of 6s. per box to compensate for the box and packing material.

The previous season the Food Controller also decided to purchase all surplus eggs, viz., at 1s. 5d. per dozen for large and 1s. 3d. for medium size.

As was the case the previous season, the prices for the present season will also be paid for unlimited quantities in Johannesburg, Durban and Cape Town, and for limited quantities in Port Elizabeth, East London and Bloemfontein. Where purchases exceed the normal requirements in the last-mentioned three centres, the organizations concerned must pay the railage to Johannesburg, Durban or Cape Town, where unlimited quantities will be purchased.

All traders, producers and producers' organizations who have eggs for sale must communicate with the Food Controller, Union Buildings, Pretoria, or with the representatives of the Food Control Organization in the principal cities.

For the protection of consumers, it has further been decided to introduce a grading system for all eggs in the chief centres of the Union and the Price Controller will fix maximum wholesale and retail prices for eggs in these centres according to grades. These grades and prices have been published in the *Government Gazette*.

1942-43 Wheat Crop—Canada.

ACCORDING to the third estimate the 1942-43 crop of wheat in Canada will be 592·7 million bushels, and although it is somewhat less than

previous estimates, it is still a record for this Dominion, as the following figures will indicate:—

Canadian Wheat Distribution.

(In millions of bushels.)

	Incoming Carry-over.	Crop.	Total Supply.	Home consumption.	Exports.	Total used or Exported.	Outgoing Carry-over.
1942–43......	424	593	1,017	139	205	344	688
1941–42......	480	312	792	146	222	368	424
1940–41......	300	540	840	129	231	360	480
1939–40......	103	521	624	116	208	324	300
1938–39......	25	360	385	115	167	282	103
1937–38......	37	180	217	106	86	192	25

N.B.—Figures for 1942–43 are estimates.

On account of the expected enormous carry-over at the end of the present season, the Government aims to reduce the acreage under wheat for the following season by 3 million acres to above 17·6 million acres compared with 20·6 million acres this season. Plans are also considered for reducing the acreage under rye by 31 per cent., while sowing of oats and barley will be increased by 12 and 11 per cent. respectively.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39 = 100.)

SEASON (1st July to 30th June).	Summer Cereals. (*a*)	Winter Cereals. (*b*)	Hay. (*c*)	Other Field Crops. (*d*)	Pastoral Stock. (*e*)	Dairy Products. (*f*)	Slaughter Stock. (*g*)	Poultry and Poultry Products. (*h*)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936–37.........	118	86	94	93	122	86	89	98	106
1937–38.........	80	106	112	118	98	112	105	107	101
1938–39.........	92	107	96	89	79	102	106	94	93
1939–40.........	86	106	77	93	116	105	106	89	104
1940–41.........	109	113	106	159	103	108	110	112	109
1941–42.........	121	132	146	205	101	131	134	163	124
1942—									
January.......	131	137	126	180	100	122	144	141	125
February......	132	138	125	168	101	130	140	147	125
March.........	126	140	140	175	101	130	134	168	125
April..........	126	139	151	170	102	130	129	175	125
May...........	158	139	188	181	102	154	132	203	136
June...........	159	139	207	180	101	154	140	218	138
July...........	159	140	183	184	166	167	154	163	143
August........	159	139	181	175	115	167	155	130	140
September.....	159	139	182	191	115	167	176	133	145
October........	159	139	156	227	115	167	181	141	147
November.....	160	154	134	189	115	139	187	146	147
December.....	160	154	123	137	115	139	178	158	144
1943—									
January.......	160	154	132	113	115	139	165	150	141
February......	163	154	130	112	115	139	156	179	142
March.........	161	154	142	119	115	139	160	216	145
April..........	159	154	142	140	116	139	163	262	148
May...........	169	154	144	155	116	163	165	316	156
June..........	169	154	165	165	116	163	166	202	150

(*a*) Maize and kaffircorn.
(*b*) Wheat, oats and rye.
(*c*) Lucerne and teff hay.
(*d*) Potatoes, sweet potatoes, onions and dried beans.
(*e*) Wool, mohair, hides and skins.
(*f*) Butterfat, cheese milk and condensing milk.
(*g*) Cattle, sheep and pigs.
(*h*) Fowls, turkeys and eggs.

* Preliminary.

Average Prices of Potatoes and Onions on Municipal Markets.

Season (1st July to 30th June)	Potatoes (150 lb.). Johannesburg. Transvaal No. 1.	Johannesburg. Transvaal No. 2.	Johannesburg. N.M. Grade 1. No. 2.	Johannesburg. N.M. Grade 1. No. 3.	Cape Town. Cape No. 1.	Durban. Natal No. 1.	Onions (120 lb.). Johannesburg. Transvaal.	Johannesburg. Cape.	Cape Town. Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940–41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941–42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 0	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December	11 6	9 6	14 1	13 3	12 2	15 6	9 3	10 11	11 9
1943—									
January	7 9	6 8	10 9	10 8	10 9	14 2	8 5	9 4	7 8
February	8 3	7 2	11 8	11 6	8 4	13 7	7 10	10 9	7 8
March	8 10	8 5	13 1	12 7	8 4	13 9	8 1	11 0	7 3
April	11 5	11 1	15 8	15 0	13 0	14 7	11 6	12 10	9 10
May	12 6	12 2	15 11	15 5	15 6	16 3	16 4	15 8	13 2
June	12 11	14 1	19 9	19 0	14 6	17 9	17 3	17 4	14 3

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

Season (1st July to 30th June).	Cabages (Bag). (a) Johannesburg.	Cape Town.	Durban.	Cauliflower (Bag). (a) Johannesburg.	Cape Town.	Durban.	Tomatoes (Trays 15 lb.). Johannesburg. N.M. No. 1.	Johannesburg. Other.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d'	s. d.	s. d.	s. d.
1938–39	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940–41	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941–42	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1942—										
January	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
September	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
October	4 2	6 10	2 5	—	4 9	5 5	2 6	1 5	2 0	1 4
November	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10
December	3 11	7 10	3 2	—	4 0	—	3 8	1 10	3 0	2 4
1943—										
January	5 1	9 0	12 6	—	—	—	4 11	2 4	2 6	2 8
February	6 4	10 2	15 2	5 7	5 8	—	5 5	2 7	1 8	2 11
March	5 6	9 6	8 6	6 6	5 11	—	3 11	1 9	1 10	2 7
April	4 1	9 5	8 1	3 2	6 1	7 4	3 4	1 7	2 2	3 1
May	4 5	6 0	7 9	3 10	5 0	7 0	4 10	2 6	2 3	2 6
June	7 6	5 5	12 8	8 7	6 1	11 11	7 2	3 8	4 0	3 6

(a) Weights of bags vary, but on the average are approximately as follows: For cabbages: Johannesburg, 105 lb., Cape Town 105 lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 65 lb., and Durban 85 lb.

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb. (a) Johannesburg. N.M. Prime.	Ordinary Prime.	Good Medium.	Com-pounds.	(b) Durban. Medium.	Com-pound.	Pigs per lb. Live Weight. Johannesburg. Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938-39........	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940-41........	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941-42........	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942—									
January........	62 3	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February........	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March........	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April........	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May........	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June........	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July........	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August........	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September........	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
October........	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November........	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December........	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January........	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February........	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March........	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2
April........	65 6	60 8	55 8	43 4	42 1	33 11	6·9	9·1	6·5
May........	65 0	59 11	55 3	43 9	42 6	37 6	7·6	8·7	6·6
June........	36 3	32 7	29 7	23 1	42 6	37 0	8·3	8·7	7·4
		No. 1.	No. 2.	No. 4.					

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.
(d) From June, 1943, prices are quoted per 100 lb. live weight, and grades No. 1, 2 and 4.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June to 31st May).	Johannesburg. Merino Wethers. Prime.	Medium.	Persians and Cross Breds. Prime.	Medium.	Cape Town. Merinos. Prime.	Medium.	Capes and Persians. Prime.	Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938-39........	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940-41........	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941-42........	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942—								
January........	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February........	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March........	9·6	8·4	8·8	7·9	9·6	8·8	9·3	8·8
April........	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May........	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June........	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July........	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August........	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September........	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
October........	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November........	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December........	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January........	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·4
February........	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·1
March........	11·5	9·8	9·0	7·3	11·7	10·6	11·1	10·2
April........	12·0	10·2	9·5	7·7	12·4	10·9	11·6	10·8
May........	12·0	10·3	9·6†	7·9†	11·1	10·1	11·1	10·3
June........	11·4	10·2	10·4	9·2	10·8	10·5	11·0	10·2

* As sold on the hoof. Reported by Meat Control Board.
† As from June "other hamels".

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

Season (1st July to 30th June).	Eggs. Johannesburg. New Laid, per dozen.	Eggs. Johannesburg. Fresh, per sozen.	Eggs. Cape Town, per 100.	Eggs. Durban New Laid, per dozen.	Hides (per lb.). Port Elizabeth. 1st Grade, Sun-dried.	Hides (per lb.). Port Elizabeth. 1st Grade, Dry Salted.	Skins. Port Elizabeth. Merino. Medium, per lb.	Skins. Port Elizabeth. Merino. Combings, per lb.	Skins. Port Elizabeth. Glovers, Sound, per skin.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938-39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940-41	1 1	0 10	8 3	1 3	5·8	6·0	4·0	7·6	2 10
1941-42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·6	9·7	3 4
1943—									
January	1 8	1 4	13 11	2 2	8·0	8·1	5·7	9·1	3 4
February	2 3	1 11	16 7	2 7	8·1	8·1	6·1	10·5	3 5
March	2 9	2 3	19 4	3 2	7·8	7·9	5·9	10 8	3 4
April	3 3	2 9	24 8	3 11	7·8	8·7	6·3	11·1	3 7
May	3 10	3 5	29 2	4 10	7·8	8·9	5·9	10·2	3 7
June	2 3	1 10	18 7	2 9	7·9	9·2	5·7	9·9	4 0

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

Season (1st July to 30th June).	Green Beans (Pocket 20 lb.). Johannesburg.	Green Beans (Pocket 20 lb.). Cape Town.	Green Beans (Pocket 20 lb.). Durban.	Green Peas (Pocket 20 lb.). Johannesburg.	Green Peas (Pocket 20 lb.). Cape Town.	Green Peas (Pocket 20 lb.). Durban.	Carrots (Bag). (a) Johannesburg.	Carrots (Bag). (a) Cape Town.	Carrots (Bag). (a) Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 1
1940-41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	13 4
1941-42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 0
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	19 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 6	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 9	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	6 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10
1943—									
January	1 9	3 3	3 5	2 4	6 9	4 7	3 9	5 1	11 3
February	2 5	4 4	3 10	4 8	5 9	5 1	6 0	6 5	11 4
March	2 8	3 1	1 6	6 7	4 5	3 10	7 9	4 0	19 1
April	2 0	2 2	2 3	5 1	3 0	2 8	8 1	6 10	23 11
May	2 11	4 11	2 11	5 11	4 8	5 2	8 5	11 1	16 10
June	6 5	4 0	4 7	6 5	5 1	9 3	9 1	13 4	18 7

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

Special Number: Soil Fertility

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CONTENTS

[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Horse Improvement Scheme "B" (Farmers).

SERVICE SEASON 1943-44.

During the service season 1 October 1943 to 15 January 1944, the following stallions will stand at stud for service of farmers' mares at the undermentioned Institutions:—

1. College of Agriculture, Grootfontein, Middelburg, C.P.: Percheron.
2. College of Agriculture, Glen, O.F.S.: Percheron and Thoroughbred.
3. College of Agriculture, Potchefstroom: Percheron, Thoroughbred and Donkey Jack.
4. College of Agriculture, Cedara, Natal: Percheron.
5. College of Agriculture, Stellenbosch-Elsenburg: Percheron.
6. Veterinary Research Station, Ermelo, Tvl.: Percheron and Thoroughbred.
7. Pretoria University, Pretoria: Percheron.
8. Dohne Experiment Station, P.O. Dohne: Percheron.
9. Oakdale School of Agriculture, P.O. Riversdale: Percheron.

The Pretoria University will accept a limited number of mares under Scheme B for the Percheron stallion maintained there. Only mares on heat will be accepted, and in no cases can they be kept longer than three days, at 1s. per day.

The main features of the Scheme are:—

(*a*) A dourine free certificate must be submitted with the application and farmers should have their mares tested early.

(*b*) Only halter-tame mares and jennies of approved type and in satisfactory condition will be accepted—mares standing 14 hands and over and jennies 13 hands and over.

(*c*) Railway charges are charged for the forward journey only.

(*d*) The service fee is £1. 1s. and maintenance costs are 2s. 6d. per week. An additional charge of 1s. per day is made for stabling if desired and available.

Full particulars of stallions and a copy of conditions of the Scheme are obtainable from every stud station.

Brine in Refrigerating Systems.

In view of the critical position in regard to Sodium and Calcium brines, and also in view of the need for reducing corrosion in refrigerating plants to a minimum, the Officer-in-Charge of Dehydration and Cold Storage, P.O. Box 3, Cape Town, has drawn up notes on the uses of brine in refrigerating plants, and methods of testing such brines.

Readers who are interested in the subject can apply to the above address for copies of the notes and also obtain particulars about advice and assistance on any problem connected with the use of brines.

New Bulletins for the Farmer.

The following Bulletins have just been published and are obtainable from The Editor, Department of Agriculture and Forestry, Pretoria.

Bulletin No. 240.—"Soya Beans in S.A.": Price 6d.

Bulletin No. 192.—"Control of Household Insects in S.A." (2nd Edition): Price 6d.

Bulletin No. 111.—"Dairy Farming" (Fifth Edition): Price 6d.

Bulletin No. 126—"Poultry Houses": Price 3d.

Special Number: Soil Fertility.

The Heritage of Our Civilization.

Foreword by Dr. P. R. Viljoen, Secretary for Agriculture and Forestry, and Deputy Controller of Food Supplies.

IN my annual report for the year ending 31st August, 1942, I stated that the effective utilization of our grazing and the maintenance of soil fertility should be primary considerations of every farmer. To-day this policy is still being rigidly adhered to by the Department of Agriculture and Forestry.

The soil was the foundation on which the civilization of our ancestors was built, and continues to remain the foundation on which the present generation is building the civilization of the future. In spite of numerous modern inventions, mother earth still remains the source of nutrition for plants and animals, including man.

It therefore gives me much pleasure to introduce this special soil-erosion number to readers. Every aspect of soil and the maintenance of soil fertility is dealt with, and practical hints are given. I therefore trust that every reader, and especially the farming reader, will find the contributions valuable, and that they will encourage him to leave this precious heritage to his descendants intact and unimpaired.

In their methods of farming our forefathers lived close to nature and gave it a chance to maintain its pristine vigour. They were

therefore able to leave us a heritage on which we could continue to build. Are we now busy destroying this heritage—the soil—and are we allowing it to be swept away to the sea, or are we applying sound methods of farming which will ensure the preservation of its fertility for posterity? Present-day methods of crop production are so inimical to nature's own restorative processes that the fertility of the soil can be maintained only by the application of sound farming practices.

The policy of the Department of Agriculture and Forestry has always been and continues to be directed at the rational production of foodstuffs, whereby the veld and soil will not only be preserved in good condition for those that come after us, but will even be improved. As has already been emphasized in my last Annual Report, it is also the fixed policy of the Controller of Food Supplies, to do everything in his power to maintain the fertility of our soil in spite of the increased demand for foodstuffs and the reduced importation of fertilizers as a result of the war.

Once again, therefore, an urgent appeal is made to all farmers to assist the Department in its efforts, so that posterity will not blame us for having neglected its heritage.

Secretary for Agriculture and Forestry.

"Foods and Cookery", Bulletin No. 115, is out of print.

Bulletin No. 237, "Eggs and Poultry in Cookery", which contains many useful recipes, is obtainable at 6d. per copy.

FARMING IN SOUTH ...AFRICA

Vol. 18 SEPTEMBER 1943 No. 210

Editorial:

The Compost Campaign.

THE problem of obtaining enough organic fertilizers is becoming increasingly acute for the farmer. During pre-war years this problem did not cause much consternation, since the attitude adopted in many circles was that the shortages of farm manure could be met by using artificial fertilizer, but when it became clear during the first years of the war that the supply of fertilizer would be greatly curtailed, the Department decided to intervene and to give guidance to farmers in the matter. A campaign was launched to manufacture "artificial farm manure" or compost on a large scale. Several years before the outbreak of war, officers of the various Divisions of the Department were very active in trying to persuade farmers to supplement their limited supplies of animal manure by making compost.

During 1942 the different groups concerned with soil fertility and crop production were united by means of a Central Compost Committee consisting of representatives of the four divisions interested in the matter, viz: (*a*) Animal and Crop Production; (*b*) Horticulture; (*c*) Soil and Veld Conservation; and (*d*) Chemical Services. The committee tackled the work from two directions: Firstly, the manufacture of compost in urban areas and towns by making use of municipal refuse, factory waste, night soil ,etc., and secondly, the preparation of compost by individual farmers on their farms from all kinds of farm waste material, chiefly of animal origin. Two officials with considerable experience in this kind of work were partially relieved of their normal duties and were instructed to organise this work. They are Messrs. J. P. J. Van Vuren and K. E. W. Penzhorn, both extension officers of the Division Animal and Crop Production. The Committee also arranges for further research work in connection with methods of making and utilizing compost. Considerable headway has already been made, and during the coming summer many farmers will reap the benefit of the information and demonstrations offered by a large number of centres. The Union is very extensive, however, and it is difficult to reach everyone. Much work still remains to be done. Large numbers of officers have, however, been included in this organization, and it can be emphatically stated that many municipalities and thousands of farmers will play their part in making compost next year. This work is of a permanent nature since even after the war compost will constitute an essential item in every progressive farmer's programme of activities.

(Dr. J. P. van Zyl, Controller of Fertilizers, and Chief, Division of Chemical Services.)

Value of Organic Material in Soil Fertilization.

Dr. J. J. Theron, University of Pretoria.

THE organic material or humus, as it is also called, occurring in the soil is an exceptionally interesting constituent of our mother-earth. It is closely associated with the origin and characteristics of soil and with the fertility and productive capacity of the latter, and confronts us with a problem which, notwithstanding centuries of study, is still shrouded in mystery. Consequently, we are all too frequently inclined in some respects to ascribe an almost supernatural share in plant growth to the soil humus, while underestimating its value in other respects.

In the past when organic materials were the only known type of fertiliger ,farmers, as can readily be understood, tended to attach an exaggerated importance to humus. However, with the discovery of artificial fertilizers and the phenomenal success achieved with the use of these mineral products, humus began to wane in popularity and was not accorded its rightful place on the soil-fertilization programme, frequently with disastrous results. During the past few years, however, we have once again woken up to its value, and now that we have again resorted to the use of substances of an organic nature on an extensive scale, it is essential that we should be fully cognizant of the actual rôle played by organic material in the soil. Already a very exaggerated importance is being attached to "compost" in some circles, and such an attitude can only lead to confusion.

The Nature of Soil Humus.

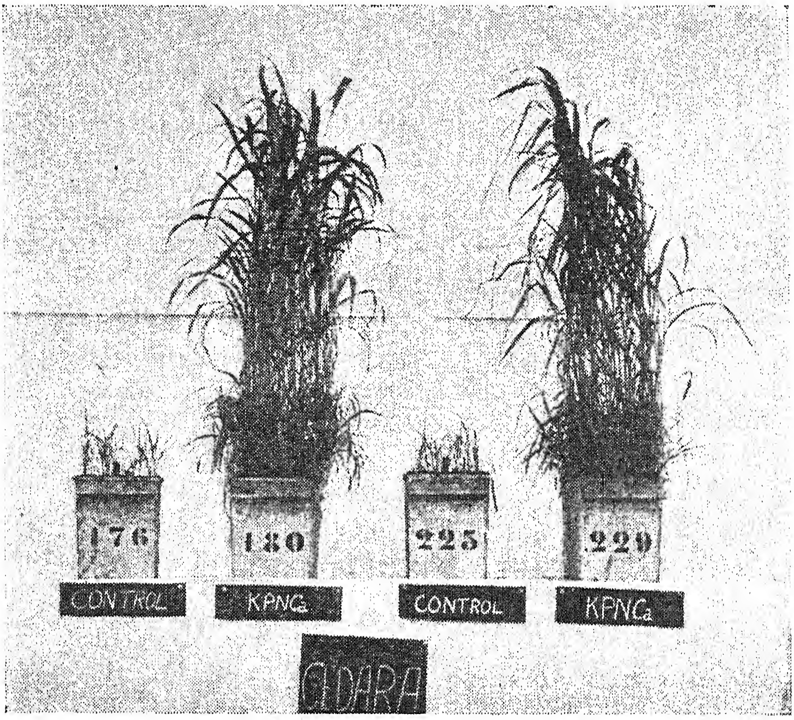
Let us now examine the function and nature of the organic material in the soil more closely.

In the natural course of its development the soil during the centuries of its formation builds up its organic matter content to a certain level. This material undergoes a process of constant decomposition, i.e., as long as the soil is warm and moist. On the other hand, destruction is also constantly made good by the remains of plants and animals living on the soil, so that, except for slight fluctuations, a state of equilibrium is established between loss and gain and the organic matter content is maintained at the same level throughout the ages. In this manner not only the humus content but the level of fertility as well, is maintained at a certain point. Directly the natural vegetation is removed, however, and the soil is cultivated, the process of decomposition is accelerated; rapid combustion of the humus takes place, the accumulated fertility is liberated and within a few years the soil becomes exhausted. The declining fertility can now be supplemented by the use of fertilizers, but as a rule the loss of fertility is also accompanied by the gradual deterioration of the physical condition of the soil, frequently to such an extent that the latter soon becomes a prey to wind and water erosion.

This condition may be temporarily relieved by the application or organic material, but within the limits of the quantities which can be applied in practice, building up of the reserves of organic matter is out of the question. The writer has repeatedly established from careful analyses that annual applications of twenty to thirty tons of manure per morgen do not arrest the loss of humus in the least. Within a year of the application of the manure, there is—in normal circumstances—no trace left of the manure, the carbon con-

tent being no higher than that of adjacent soil which received no application.

Indeed, it is evident that the value of organic matter does not lie so much in its presence in the soil, as in its effects on the soil resulting from its decomposition. There are, for example, soils in the eastern Transvaal in which manure takes an exceptionally long time to decompose. It is not surprising, therefore, to find that crops in these soils derive hardly any benefit at all from the application of manure. If manure is to be of any value, it must be combusted in the soil and there unleash its power and liberate its salts.



Cedara Soils: Fertilized and controls.

The object of applying organic fertilizers to the soil is not to build up the humus content, for this is impossible, but to furnish the soil with fuel for the mechanism living and functioning within the framework of the coarse grains of sand.

The Action of Organic Material.

What happens when the organic material decomposes in the soil and what does it impart to the soil? In normal soil the combustible material is destroyed and vanishes within a comparatively short period, but during the process it exercises several important functions, the most important of which is perhaps the provision of food for plants. Twenty tons of farm manure per morgen is a very ordinary application, but this amount easily contains as much plant food as one ton of a good fertilizer mixture, which would be an exceptionally heavy application per morgen. Another function which the decomposing manure fulfils is that of enriching the salt content of the soil solution—a very important factor in the main-

tenance of the soil structure. As a result of the loss of the natural organic material the particles of clay become very sensitive and the vital soil crumbs readily disintegrate. Upon the application of manure and its decomposition in the soil, however, the clay particles again, even if it is only temporarily, come under the protective action of the gelatinous humus colloids, and with the aid of the salts which are liberated, the soil crumbs can again reform; bacterial life is revived and the circulation of plant feeds stimulated. As a result of the recovery of the soil crumbs, the physical structure is improved, water is more readily absorbed, the soil is less subject to wind or water erosion, aeration is improved and, generally speaking, the soil is now more favourable to plant-life.

We cannot, however consolidate the effect; the applications must be repeated from time to time and, as in the case of artificial fertilizers, there is no reason to assume that *the process can be repeated indefinitely*.

The Actual Value of Organic Material.

It is in the light of the above that we should judge the intrinsic value of compost, kraal manure, green manure, etc., and decide to what extent any costs entailed in their use are justified.

For soils under irrigation the use of organic material in some form or another is absolutely essential, since by keeping the soil constantly moist and leaching out the salts, irrigation results in the accelerated exhaustion and impoverishment of the soil. Moreover, the system of farming generally practised under irrigation is of such a nature that soil impoverishment cannot be controlled in any other way than by the application of these substances.

In the case of normal dryland cultivated soil, however, the real value of organic fertilizers consists of little more than the immediately available plant nutrients contained in them. In making this statement the writer does not by any means wish to create the impression that manure and compost have no other values besides their plant nutrient content, but these subsidiary values should be made good in some other way, viz., by the periodical planting of a perennial crop such as grass or lucerne. This is the only really sound way in which to build up the organic material content, to control erosion and to restore the natural fertility of the soil.

Compost and Maize Yield.

MR. BLACK is a dairy-farmer and supplies fresh milk for urban consumption. During the winter months his cows sleep in the byre at night. Near the byre is a deep hole in which he collects all the manure and into which the urine from the stable runs. During the winter Mr. Black cuts as much grass in his vleis as possible for use as bedding and also for making compost. For this purpose alternate layers of grass and manure are thrown into the hole. In this way Mr. Black produces about 270 tons of compost a year, so that each land on his farm receives a good application of compost once every five years.

This year Mr. Black reaped a record maize crop on one of his lands (approximately 9 morgen in extent) which received a compost application of 20 tons per morgen last year. The yield on this piece of land was 200 bags of maize, or, in other words, 22 bags per morgen, the record yield per morgen for any previous year having been 14 bags per morgen.

(Submitted by J. J. S. Cilliers, Extension Officer, Kokstad.)

Soil Structure.

Dr. C. R. v. d. Merwe, Division of Chemical Services, Department of Agriculture and Forestry.

AGRICULTURE is the principal industry of most of the larger countries in the world, including South Africa. The soil is the basis of agriculture, irrespective of the type of farming carried on, and is therefore the most important natural asset on which our national prosperity, and welfare depend. Consequently, it is the duty not only of the rural dweller or farmer but also of the townsman to preserve and protect the soil. We are dependent for our very existence upon the maintenance of the soil and any deterioration or destruction of our soils, either as a result of exploitational cropping which exhausts soil fertility, or of trampling which promotes erosion, endangers our existence. In the past soil destruction has led to national deterioration and even to national ruin.

Soil Groups in the Union.

Soil is the product formed as a result of the disintegration of the matrix or parent rock brought about by various factors such as climate, vegetation, topography, etc. Since these factors may vary greatly in their interactions, it is only natural that the soil product should also lack uniformity. Consequently we find in the Union and along its borders soil groups with various characteristic features. The following are a few examples of the recognized soil groups of the Union:—

(*a*) The grain soils and (*b*) the sandy soils at the foot of and on the mountain ranges of the Western Province, (*c*) the reddish-brown clay soils of the mist belt of the Transvaal and Natal, (*d*) the black clay soils of the Transvaal, wrongly termed "turf" in Afrikaans, (*e*) the desert soils, (*f*) the Kalahari sand and Kalahari sand on lime soils, (*g*) the maize soils of the highveld, etc.

Generally speaking, the well-developed soil types of the various soil groups enumerated above, consist of a variety of horizons or layers which may be classified as follows:—

(i) The topsoil or vital surface soil, (ii) the subsoil which is less suitable for cultivation and (iii) the subterranean layers which are somewhat similar to the subsoil.

Although the soil types of the various soil groups have all the abovementioned layers, they nevertheless differ very greatly, layer by layer, in so far as their available plant nutrient content and physical properties are concerned.

Structure and Fertility.

The physical properties of a soil are determined largely by its structure, which is regarded as the key to fertility. Soil structure is usually defined as the arrangement of the soil particles into certain aggregates which, according to their formation and properties are described as crumbly, granular, cloddy, etc.

There are also certain soils in which the soil particles do not adhere to one another and the structures of these are described as single-grained, mealy or dusty.

Each of the above structures is characteristic of one soil group or other in its uncultivated state. Of the abovementioned structures the crumbly and granular lend themselves best to cultivation.

In this article a brief description is given of the agricultural importance of the soil structure, the method of bringing about the

ideal or desired structure if it does not exist in the original soil, and the means by which a structure which has been damaged by cultivation can be improved.

Typical Characteristics.

In deciding whether a piece of land is suitable for agricultural purposes, particularly for irrigation, special attention must be given to its physical properties. If the latter are favourable, the land can without hesitation be recommended for cultivation, in spite of any deficiency of plant nutrients. Soils with good physical properties will produce good crops if fertilizer is applied. The matter is not so simple, however, in the case of soils with unfavourable properties. A soil with favourable physical properties possesses a good water-absorbing and water-retaining capacity, shows reasonable surface and internal drainage, is well aerated, has no layers in its profile which are impervious to water, air and root penetration and can readily be worked into a seed-bed which will serve its purpose and in which micro-organisms can thrive.

For the practical agriculturist it is essential, especially if he wishes to apply irrigation, to determine by means of fairly deep holes whether the soil satisfies these requirements and so justifies the costs of the undertaking.

Improvement of Structure.

How must an agriculturist proceed if he wishes to improve a soil which originally possessed an inferior structure or which has deteriorated as a result of cultivation? There are various methods at his disposal, all of them being based on the principle of adding to the soil something which would have the effect of binding the flocculated soil particles into an aggregate which is relatively stable under the necessary soil cultivation.

The application of lime compounds to a soil frequently has a favourable effect on the physical properties of such a soil, but this improvement is not of a permanent nature. They only have a flocculating effect, since the binding medium is absent. A calcium application, especially in the form of gypsum, is the first step towards the reclamation of puddled "brak" soils.

The presence of minute clay particles in soils is largely responsible for the cementing of the separate soil particles into crumbs or granules. The properties of the soils concerned are to a large extent determined by the other binding material and also by the chemical composition of the clay.

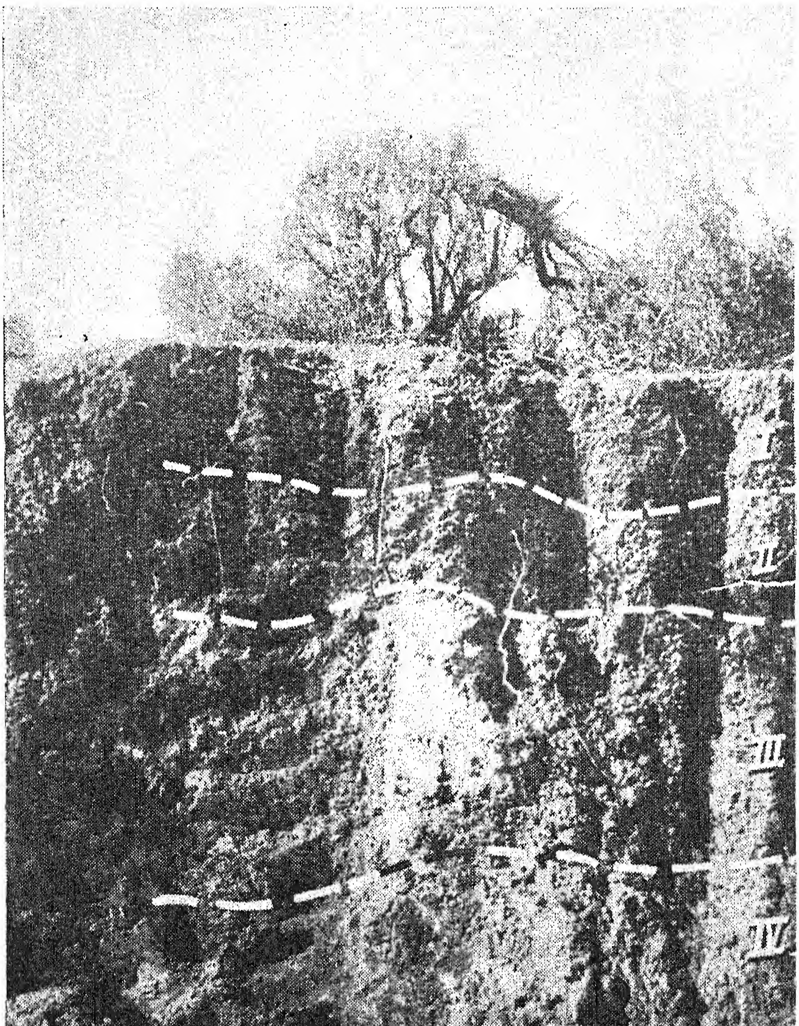
Organic Material.

A well-known and infallible method of improving the physical properties of soils, is the application of organic material in the form of kraal, stable and farm manure, and compost. Colloidal organic material is just as effective if not better than, clay for massing soil particles into stable crumbs. Farmers are therefore strongly advised to apply manure to an increasing extent for the improvement of the physical properties of soil.

Red and reddish-brown ferruginous soils have inherently favourable physical properties. This is due to the presence of iron oxide and alumina which bind the soil particles. It is the duty of the agriculturist to maintain the iron compounds in their original form irrespective of what he intends applying in the way of manure or fertilizer for the improvement of the soil structure. Water-logging as a result of injudicious irrigation or the obstruction of surface

drainage may easily change the composition of the iron compounds to the detriment of the favourable properties of the soil.

It is possible to build up the soil structure by the application of manure, lime and other measures at our disposal, in conjunction with judicious cultivation. Certain soils such as for example, the black clay of Transvaal require drying for their structural improvement. If such soils are continually planted to crops throughout the



Calcareous Soil of Colluvial origin, Beaufort West, C.P.

I.—Greyish brown sandy loam structureless with some lime concretions.
II.—Light brown, speckled white fairly loose calcareous loam.
III.—Similar to II, but crumbly and contains more lime concretions.
IV.—Whitish grey, otherwise similar to III.
Overlying decomposing rock.

the other hand, with soils that are still in good heart (and thus not seriously lacking in humus), the position is more or less reversed. With the advent of commercial fertilizers a very general tendency has, unfortunately, risen to interpret soil fertility purely in terms of crop yields and to neglect the more basic implications in regard to the stability of the soil. The use of fertilizers alone may give increased crop yields for a shorter or longer period, but has little to do with the system of land use as such, and will certainly not maintain soil stability in the absence of other special measures designed to this end. Commercial fertilizers, particularly phosphates, will no doubt always have a place in local agriculture, but they must be regarded, not as the mainstay of crop production, but merely as an adjunct to improved production on soil whose stability is permanently ensured under the system of land-use employed.

Humus Essential for Healthy Plant Growth.

Apart from the more obvious manifestations of humus depletion in the way of declining productivity and increased erodibility of the soil, there is a growing school of opinion, with Sir Albert Howard in the lead, which maintains that the matter goes much further, in that an adequate supply of humus is essential (by virtue of the "mycorrhizal association" established between plant roots and soil humus) for the full nutrition of plants and the production of healthy crops. The term "healthy", as used here, implies both nutritive quality as food for animals or man, and resistance to disease: it is claimed that crops grown on soils deficient in humus, with or without the aid of commercial fertilizers, are not only of inferior quality as foodstuffs, but also show a marked increase of susceptibility to disease and even to attack by insect pests. From this it is logically argued that the common approach to the problems of animal and human malnutrition and plant disease is fundamentally wrong, in that it deals with effects rather than causes, and that the correct approach to these problems is through the soil itself, the solution lying basically in the maintenance of the "health" of the soil, which is primarily dependent on its humus content. Scientific orthodoxy does not permit of general acceptance of these views in their entirety as yet, mainly owing to lack of supporting evidence from controlled experiments capable of statistical analysis; but these views are strongly supported by a large and growing volume of practical evidence, based on long experience and observation under field conditions. It is true that plants may be grown with apparent success in water or sand culture containing no humus, but, in the absence of proof to the contrary, it seems safe to assume that plants grown under such unnatural conditions cannot be fully healthy in the sense used above and, furthermore, that they will speedily fail to produce viable seed. In any case, while the precise rôle played by soil humus in relation to plant nutrition still remains to be elucidated, there can be no doubt as to the indispensability of this soil constituent under field conditions, or as to the basic soundness of the postulate that a healthy soil produces healthy crops, and hence healthy animals and healthy human beings.

Land-use to Maintain Humus Content.

All the foregoing serves to emphasize the fact that the first essential of *permanent agriculture* is to adopt systems of land use that will maintain the humus content of the soil at a satisfactory level. With this as the foundation of sound land use, due attention may then be given to the specific requirements of particular soils

[*Continued on page 636.*

Crop Residues and Soil Fertility.

Dr. D. G. Haylett, Professor of Agronomy, Agricultural Research Institute, Pretoria.

ORGANIC matter, as its name implies, is material derived originally from living things—plants, animals, insects, bacteria, fungi and other micro-organisms. That it plays an important part in soil fertility is supported by an enormous volume of evidence. In the case of agricultural soils the organic-matter fraction is derived largely from the growth and decay of the natural vegetation which such soils have supported through the years of history and pre-history. In spite of the fact that the natural plant cover has grown and died for generation upon generation, the actual amount of organic matter in a virgin soil always remains comparatively small. While fresh additions are continually being made by the decomposing plants of the veld, at the same time parallel losses must also be occurring at a more or less similar rate. This is essential in order that, on balance, the organic matter may remain fairly constant. There is little evidence of an ever-increasing storing-up of organic matter in grass-covered soils. The facts suggest the operation of a balanced mechanism of addition and subtraction operating continuously. This concept is of first-order importance in understanding the contribution which additions of organic matter make to problems of practical soil fertility.

Although much is being written about organic matter, in various forms, in relation to problems of soil fertility and soil stability, very little is known about the manner in which organic matter functions in a soil and how it brings about an improved nutritional status of the crops which the soil supports. How it contributes to the fertility and stability of agricultural soils, the extent to which the organic-matter fraction can be built up artificially and maintained permanently in a cropped soil, are questions still requiring answers.

Effects of Crop Residues on Maize.

In this article will be discussed the effects of turning-under crop residues on the growth of maize crops which follow. The discussion is based on the data provided by a long-term field experiment commenced in 1929 at the Experimental Farm of this Institute. It is, however, impossible to present the data in great detail as they cover a period of 10 cropping seasons and involve the yields of nearly a thousand plots. Nor is it possible to discuss the details of the statistical methods used in assessing the significance of the data and the accompanying inter-actions upon which the arguments are based. It may be mentioned, however, that the experiments were carefully designed, with the necessary replications and controls, and with the requisite attention to the other technical matters with which agronomic experimentation is concerned. The conclusions reached are necessarily confined to issues raised by the design of the experiments in question.

Briefly, the experiments involve the study of five three-year rotations in which one crop is turned under wholly or in part as a residue crop, thereby providing a considerable addition of organic matter for the other crops in the rotation. The effect of the residue

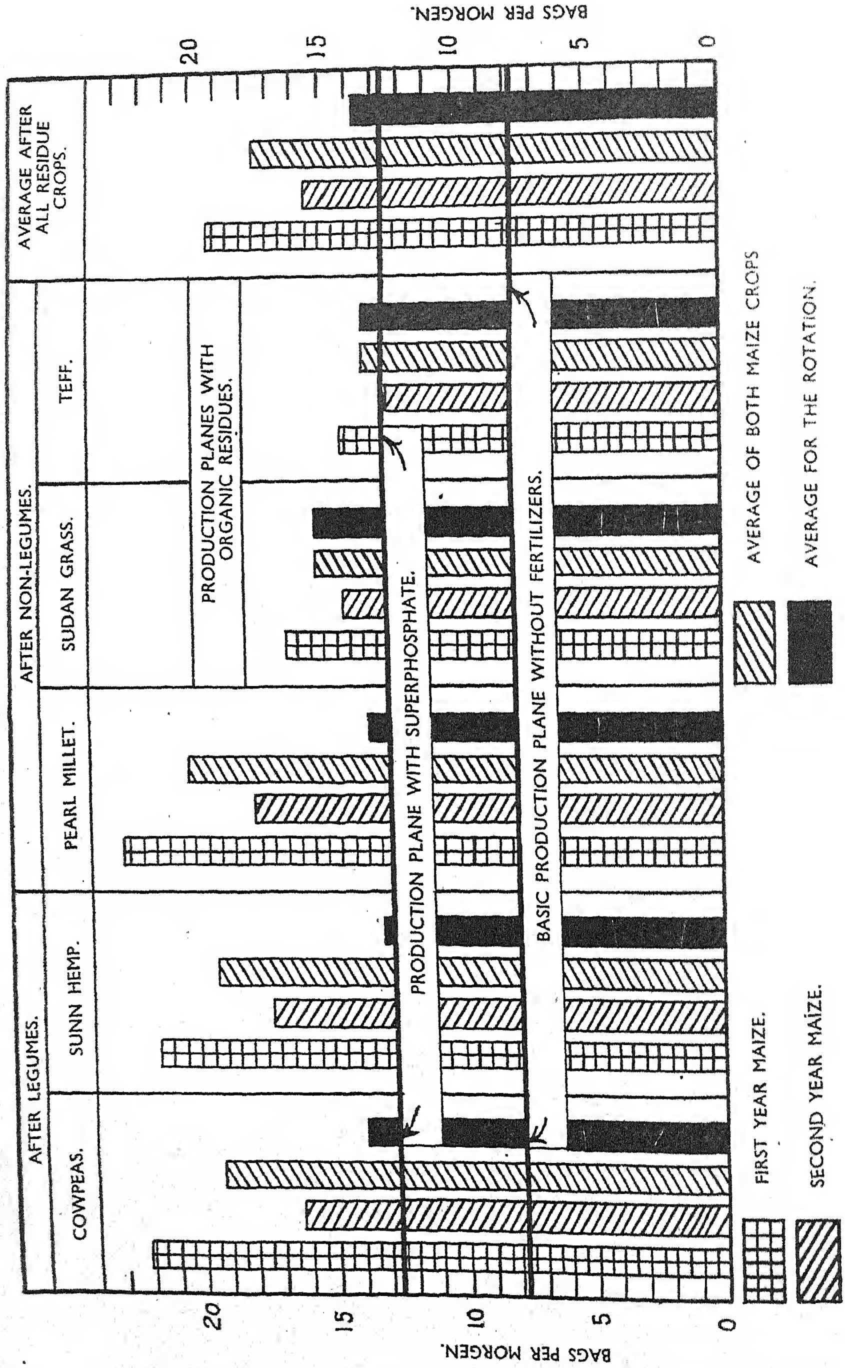


Fig. 1.—Ten-year average annual production of maize grown in rotation with cowpeas, sunnhemp, pearl millet, sudan grass and teff respectively [average for rotation" = (yield of first year maize and yield of second year maize) ÷ 3.]

crop is assessed quantitatively by the result which it produces on the maize crops which follow. The rotations are:—

A. Cowpeas ploughed under; maize; maize.
B. Sunn hemp ploughed under; maize; maize.
C. Pearl millet ploughed under; maize; maize.
D. Sudan grass, harvested as a hay crop, the aftermath only being ploughed under; maize; maize.
E. Teff, harvested as a hay crop, the aftermath only being ploughed under; maize; maize.

In the case of rotations A, B and C, the whole crop of either cowpeas, sunn hemp, or pearl millet after being mown, weighed and chaffed, is spread on the plots and ploughed under at about the end of February, while the soil is still moist after the summer rains. Decomposition is more rapid in the case of sunn hemp and cowpeas than in the case of the other crops. In rotations D and E, the Sudan grass and the teff are harvested for hay at about the end of February and the second growth or aftermath is allowed to develop. About a month or six weeks later this aftermath is ploughed under.

The soil is a red sandy loam which is fairly typical of the Pretoria District. Without fertilizer of any description the soil for more than ten years has given an average of about 8 bags to the morgen without showing any tendency to deteriorate. This soil is clearly deficient in phosphorus, as the addition of an annual dressing of 200 lb. of superphosphate per morgen raised the average maize yield to over 12 bags per morgen. In an adjacent experiment no significant increases in the maize yields have been obtained with moderate applications of either nitrogenous or potassic fertilizers. There is evidence to show that the soil responds markedly to applications of farm manure.

The whole experimental area is winter-ploughed in about August after receiving a broadcast application of superphosphate at the rate of 200 lb. per morgen. Only the unfertilized controls receive no superphosphate. As the soil is subject to wind erosion, it is usually left in a rough condition after ploughing. At the beginning of the rainy season in November the land is worked down to a fine seedbed before the crops are sown. The crops are husbanded in the usual manner and particular attention is given to clean-cultivation of the maize crops.

Experimental Results.

(1) *Effect of Residues on Maize Yields.*—The first point of interest is to know whether or not the ploughing under of crop residues is influencing the production of the succeeding maize crops, and to what extent in contrast with a system of continuous cropping with maize only. The data, presented in summary form in Fig. 1 show unquestionably that the residues result in increased yields in both the maize crops which follow the residues. In the case of the rotation involving teff residues, however, the effect does not extend to the second maize crop.

The next point of interest is the extent to which the various kinds of organic residues differ among themselves in their ability to increase the production of maize, and whether such differences are in the same relative proportion when estimated from either of the two maize crops. Judged on the basis of the average production of the two maize crops taken together, the pearl millet is producing significantly higher yields than the other residue crops contrasted; cowpeas and sunn hemp are in turn superior to Sudan grass and teff; and finally the Sudan grass is better than the teff. These results

are also reflected in the yields of the first and second maize crops in the rotation considered separately. The response is roughly proportional to the weight of the crop residues ploughed under and is not materially different for legumes and non-legumes. That pearl millet, sunn hemp and cowpeas produce a larger effect than either Sudan grass or teff, bearing in mind that only a comparatively scant aftermath is ploughed under in the case of the latter two residue crops, is not in conflict with what might be expected.

(2) *Effect of Residues on Successive Maize Crops.*—The striking beneficial influence of crop residues, stated in measurable units amounts to about 4·8 bags per morgen of maize more than is obtained from maize grown in continuous succession. This advantage, however, appears to be comparatively short-lived. The recorded increase for the first maize crops in the rotation is 6·7 bags of grain to the morgen, whereas for the next maize crop which follows the advantage drops to 2·9 bags. Assuming that this diminishing rate is maintained, it is predictable that fourth and succeeding maize crops would not reflect any further benefit which is statistically measurable. The transient nature of the effect of crop residues is illustrated graphically in Fig. 2.

(3) *Effect of Season on the Response to Residues.*—One of the main factors determining the yields of crops under dryland conditions is the seasonal complex and all that it embraces. In years of drought the yields of all crops are low; in good years the yields are higher. Generally, the rises and falls are similar in all five rotations, nor can any cumulative tendency be detected by a statistical examination of the data. This implies that there is as yet no additive benefit resulting from the continued use of crop residues. This situation is shown graphically in Fig. 3.

Discussion.

(1) *Technical Implications.*—The results presented here demonstrate very clearly that two things happen when crop residues are ploughed under and are followed by maize in rotation. The first is that the maize yields are increased very substantially, and the second is that the increased productive capacity conferred on the soil is short-lived. This behaviour happens fairly consistently, regardless of seasonal fluctuations in the weather, and is irrespective of the type of crop used as a source of the residue material. Legumes and non-legumes behave in much the same manner, but the degree of benefit is roughly proportional to the quantity of material turned under.

It does not appear that the mode of action of the crop residues is to modify the soil-moisture relationships by temporarily raising the water-holding capacity of the soil. For if this were so, it would be expected that the seasonal variations in rainfall would play a larger part in the interactions than the data actually indicate. Nor does it appear that the nitrogen nutrition is primarily involved. Non-legumes as well as legumes, behave similarly as a source of residue material and in any case it has been shown experimentally that nitrogen additions to this soil are without measurable effect on maize yields.

The rapid decline in the effect of organic residues turned under suggests that the benefit noted is intimately associated with the decomposition process. It is possible that the residues may provide a suitable energy substrata for enhancing the activities of soil micro-organisms which in turn affect the nutrient balance of the soil-solution. But quite apart from any indirect rôle which micro-organisms may play, the residue crops will have performed two

additional functions, viz., (i) the collecting of available nutrient ions during the season of growth, and, (ii) the releasing of the same nutrients during the period of decomposition. On the evidence available it would appear that the mobilization of nutrients is the chief way in which organic residues function in raising the fertility of the soil. The delayed action of the residue crops, covering a period of perhaps two or three seasons, suggests that the release of nutrient ions by the residues takes place slowly. But once the nutrients have been released the process comes to an end.

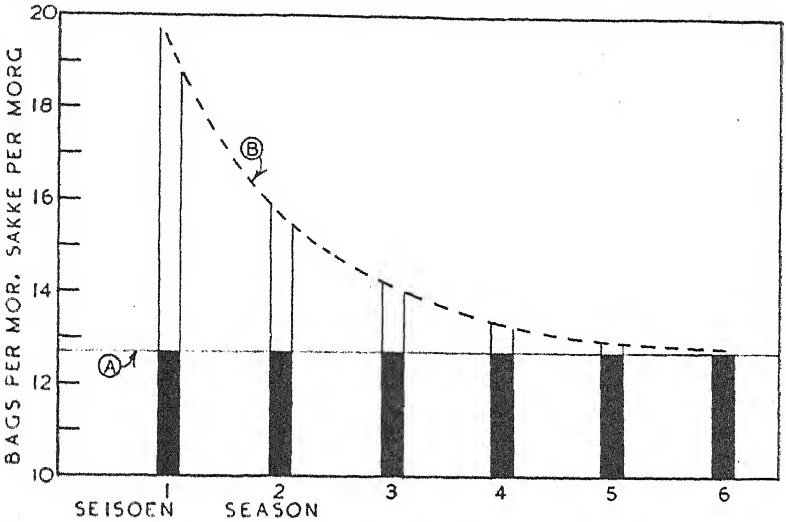


FIG. 2. Diminishing production of maize following crop residues.
A. Production of fertilized controls.
B. Production of maize after residues in the first and succeeding seasons.

The evidence suggests that, of the nutrients concerned, the phosphate ion is probably the main one. It is well known that a small annual addition of a phosphatic fertilizer produces a marked increase in maize yield. But at the same time continued small annual dressings of superphosphate do not produce increasingly greater yields. It is a physiological impossibility for all of an added quantity of phosphate to be taken up by a crop in one season. The unused remainder must accumulate, therefore, but in a form in which it is unavailable, or at least less readily available, than when first applied. At any given time only a small proportion of the total phosphorus in a soil, both natural and that added artificially, appears to enter the soil solution. The same is probably true for all ions involved in mineral nutrition.

The function of crop residues seems to be to bring about a temporary modification in the quantity of ions at the disposal of the succeeding crops. The part played by organic matter, then, is not the addition of a new substance not already present in the soil which can be used directly in plant nutrition, but rather the provision of a mechanism whereby a more satisfactory condition of the soil solution can be brought about. It also provides a system in which the loss of nutrients by leaching can be avoided and at the same time maintained in a form readily available at comparatively short notice.

It is interesting to speculate, in the light of the results observed, on the possible rôle which decomposing plant remains play in a soil covered with natural grasses in an undisturbed state. A perennial grass cover after many years, possibly centuries, produces a marked degree of stability in a soil. Stability in that its production is maintained at a given level, and stability in that it does not erode easily unless something very drastic occurs to upset the balance between growth and decomposition, such as for example ploughing or even severe over-grazing. There is evidence to show that when under continuous veld cover the carbon content of a soil, similar to the one used in the experiments discussed, is considerably higher than after it is ploughed up and used for growing crops for several years. In the natural state a constant organic-matter level is produced and maintained by a process of addition and subtraction which is in balance. As it is well known that the carbon and nitrogen are also in balance represented by a more or less constant proportion—in this soil about 12 or 13 to 1—it may be inferred that the nitrogen content remains more or less constant as well. It is not unreasonable to conclude that the organic matter in a soil covered with grass also stabilises other ions as well as the nitrogen.

Under conditions of arable cropping the state of affairs is very different. With the continued working of the soil and with crop removal the natural balance is upset. The co-ordination between organic matter, loss and replacement is disturbed and the productive plane changes to a new level characteristic of the system of management imposed. If the mobilization as well as the stabilization of nutrient ions is conditioned by the organic-matter fraction, it follows that a cultivated soil must be less stable and in time mobilization must be less satisfactory than a grass-covered soil.

It is possible that herein lies the reason why organic matter additions are beneficial in re-establishing a sward, but are without much effect once it is established on the higher productive plane. Thereafter the plane of production appears to be maintained automatically, provided the balance between growth and decay is not disturbed.

On the other hand, under a system of annual cropping with merely an occasional application of organic matter or return of crop residues, the higher plane of production cannot be maintained for longer than a comparatively few seasons. No known systems of annual cropping are capable of raising the mobilizing power of a soil and maintaining it permanently at a level higher than the limit which is characteristic of the soil. In other words, it does not seem to be possible to " build up " the fertility beyond a certain level.

In the light of the above discussion it is obvious that a more satisfactory system of crop production, aimed at the maintenance of the stability of the soil, would involve the use of a perrennial grass crop in the rotation. It is maintained by some authorities that artificial composts and animal manures are the only means whereby soil deterioration can be avoided and that the essential feature in their functioning is the so-called " animal factor ". It has not yet been demonstrated in what manner the products of animal metabolism confer additional properties to residue material in improving its efficacy or in prolonging its action. In the experiments reviewed here, the animal factor is specifically excluded, and the explanation offered to account for the results observed must be confined to factors other

than those associated with the animal. That substanial beneficial effects accrue from the use of crop residues even in the absence of the animal factor, has been demonstrated. This does not imply, however, that even greater crop responses could not have been expected had other issues, such as the effect of animal compost, been included in the investigation.

(2) *Practical Considerations.*—Although the final aim which applied research envisages, is to bring about improvements in the practical application of the findings, it should be borne in mind that the present discussion deals more specifically with some of the fundamental aspects of the problem. The main purpose of this review has been to interpret the results in the light of the circumstances under which they were obtained. It is unwise to attempt to generalise without due consideration of the wider surrounding issues.

Use should not be made in practical farming of the evidence presented without further consideration and qualification. At present arable farming is carried on for the main purpose of producing crops for profit, whether by direct marketing of the product for cash or by indirect conversion into other saleable goods, such as milk, meat, wool and the like. The decision to adopt a system of soil or crop management must unfortunately take its colour from considerations of direct or indirect financial gain.

When a three-year rotation—such as selected to study the effect of crop residues—is adopted, two-thirds of the land will be under maize each year. Of this area one-third will be "first-year" maize, and one-third will be "second-year" maize, the former will on the average out-yield the latter. One-third of the land will be used for purposes of growing the residue crop each year and will be unproductive except in so far as the yields of the succeeding maize crops will be increased. As maize is grown every year, the effect of seasonal fluctuations will operate on the rotatively grown maize to the same extent as in the case of maize grown continuously and is, therefore, a factor common to both systems and need not prejudice either.

The data obtained experimentally show that a smaller area of maize will, in fact, produce substantially the same or slightly better yields under a system of rotative cropping than when maize is grown on a larger area in monoculture. The total area of land involved for the two contrasted systems is, however, the same, because the residue crop—which is not immediately profitable—is also grown each year. In the case of the rotation with pearl millet, the advantage accruing to the farmer would be slightly better than in the case of either cowpeas or sunn hemp. With Sudan grass and teff, the end result would not be very different, provided the values of the Sudan grass hay and the teff hay harvested could be assessed as having a value in cash equivalent to that of an ordinary maize crop grown on the same land. At the same time the costs of harvesting and curing the hay crops would be additional expenses which do not appear in the cases where whole crop residues are turned under.

The labour involved in ploughing and soil preparation will not be different under the two systems, but the ploughing under of the green-manure crop would be done under more favourable circumstances—when the soil is still comparatively moist—and at a more favourable time of the year in respect of labour utilization. The cultural operations involved in husbanding the residue crop are fewer, weed control is simpler, cultivation is less and the harvesting expenses are eliminated. These benefits are considerable. The harvesting of

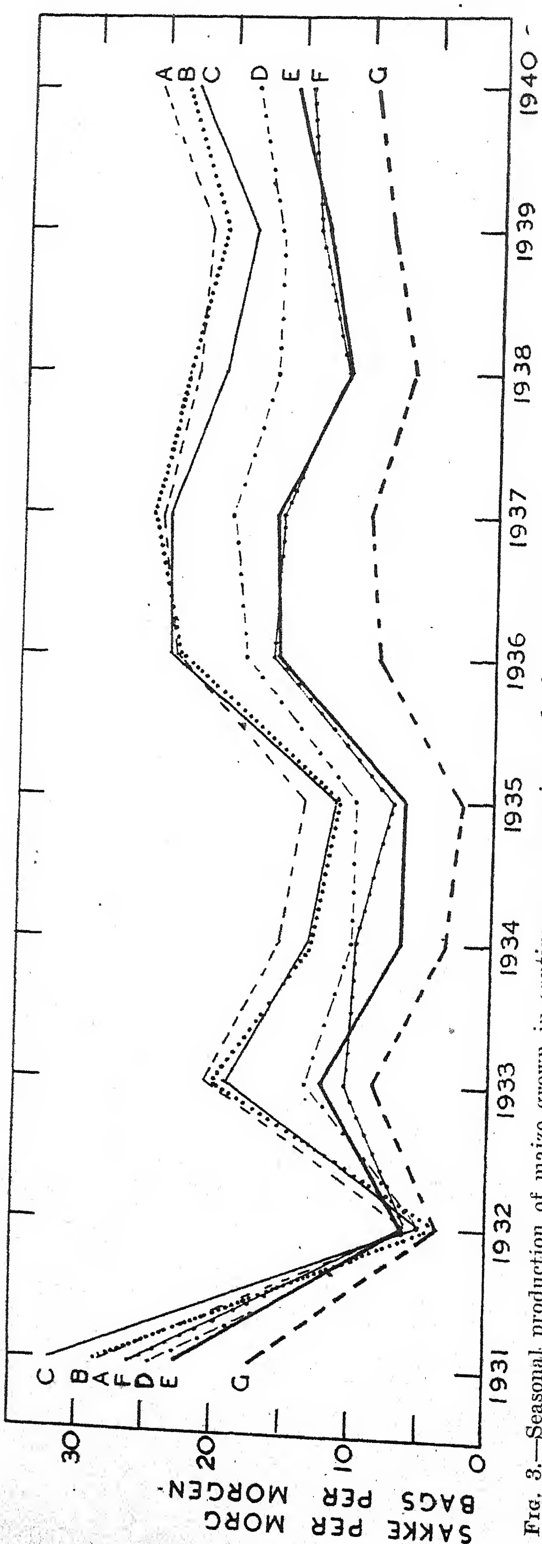


FIG. 3.—Seasonal production of maize grown in continuous succession and after residue crops.

A.—After Pearl milled.
B.—After Sunn hemp.
C.—After Cowpeas.
D.—After Sudan grass.
E.—Maize grown continuously (fertilized control).
F.—After Teff.
G.—Maize grown continuously (unfertilized control).

maize on an area only two-thirds the size of that under continuous cropping must, from a practical viewpoint, be somewhat cheaper as there are fewer plants but larger cobs to harvest.

In all the circumstances it must be admitted that by the adoption of one of the three-year rotations discussed above, the farmer would be somewhat better off financially than if he grew maize continuously. His husbandry would be better. He could not expect, however, that the ploughing under of whole crop residues would give him an immediate cash benefit as spectacular as the experimental results might suggest. For it must be remembered that two morgen of land must produce at least as much maize as three morgen of land continuously cropped with maize before he can expect to derive any extra cash benefit as a result of the sale of his maize.

On the other hand there are also other issues, not specifically included within the scope of the experiments, which are important—the question of disease and insect control, for example, and the general physical state of the soil.

The need for greater diversification and more inspiration in cropping policy is admitted, and it is to be recommended that, provided a farmer does not lose financially by the operation, he should at least rotate his crops. The actual details of the procedure may have to be modified according to local circumstances, according to the relative value of the crops rotated, and according to the prospects of stability in market prices. In practice it is, unfortunately, financial considerations which force the adoption of a cropping policy on a farm and not technical considerations aimed at the most beneficial utilization of land, without prejudice to its stability. For example, any crop which enjoys a measure of price-stabilization tends to force out of production alternative crops which do not enjoy similar financial protection, but which otherwise might be grown to advantage in the interests of a national nutrition policy or in the interests of soil protection and improvement.

Summary.

(1) The results of a long-term field experiment on the ploughing under of crop residues derived from cowpeas, sunn hemp, pearl millet, Sudan grass and teff are discussed.

(2) The data show that two things happen when crop residues are incorporated in the soil. An immediate and striking increase in maize production follows. This increase is of a temporary nature, diminishing rapidly after the first season and persisting for probably not more than three seasons.

(3) The implications of the results in practical crop production are discussed. In spite of the spectacular responses of crops which follow, the incorporation of organic residues, the application of a system of ploughing under whole-crop residues in practical farming operations would depend on financial and other considerations.

(4) The evidence presented leads to the opinion that the way in which the crop-residues function, in bringing about a non-permanent stimulation of productive capacity, is probably by mobilizing nutrient ions and thereby increasing their availability. The soil on which the experiments were conducted was manifestly deficient in available phosphorus and in all probability it was the mobilization of the phosphate ion that was primarily concerned in producing the results

observed. Under the system of arable cropping, mobilization is apparently stimulated by means of organic residues for short periods only and the process lacks the quality of continuity. On the other hand under grass this mobilization is thought to be a continuous process which has the effect of raising and maintaining the fertility plane above that which exists under a system of annual cropping.

Utilization of Arable Land:

[Continued from page 626.

in regard to lime, phosphates and such like, with a view to the further enhancement of crop production. At the same time improved cultural technique is called for to make full use of the available moisture supplies by reducing water run-off (and consequent soil loss) to a minimum: the steeper the slope of the land, the more important is this point, especially so in areas that are subject to heavy downpours over short periods of time. Always bearing in mind that the major function of arable land must be to produce animal feed, the above requirements can be met in practice by: (i) crop rotation, with adequate provision for the inclusion of soil-building fodder crops; (ii) returning all available plant and animal wastes to the soil, preferably in the form of compost; and (iii) contour-farming and strip-cropping on sloping land.

Nursery Quarantines.

The following nursery quarantines were in force on 1 August, 1943:—

(1) Page's Nurseries, Franschoek, C.P., on citrus (all), for red scale.

(2) Beaulieu Nurseries, Forestdale Siding, P.B. Grahamstown, C.P., on citrus (all), for red scale.

(3) Municipal Nursery, Randfontein, on palms (all), for circular purple, Ross and Spanish red scales.

SHORTAGE OF TETROL.

THE Director of Veterinary Services, Onderstepoort, announces that owing to the shortage of one of the ingredients of tetrol it is at present no longer possible to prepare supplies of this remedy. In view of the prevailing war conditions, it is extremely difficult to say when supplies will be available again, but as soon as this Institution is able to resume the preparation of tetrol, the necessary notification will be given in regard to the matter.

Farmers are therefore requested not to place any further orders since any money forwarded, must merely be refunded.

Popular Bulletins.

(1) Calf Rearing—Bulletin No. 224. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

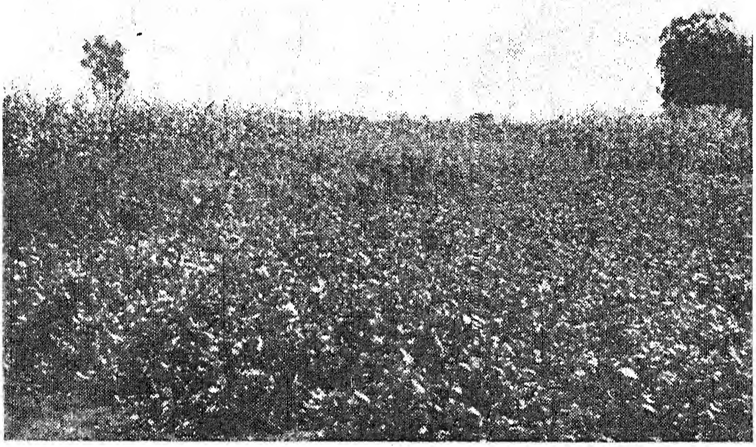
(2) The Export of Fresh Grapes from the Union of South Africa during the Ten-year period, 1930-39—Bulletin No. 225. Price 6d. Obtainable from the Chief, Division of Horticulture, Pretoria.

(3) Soft Cheese as a Food—Bulletin No. 229. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Rotational Cropping and Green Manuring for Soil Fertility.

F. X. Laubscher, Agricultural Research Officer, College of Agriculture, Potchefstroom.

THE quantity of organic material naturally present in the soil will depend upon the climate. Where the relationship between rainfall and evaporation is the same, it is primarily the temperature which determines the level at which the humus content of the soil will be stabalized. For this reason it is physically impossible to increase the humus content of any soil above the level set by the climate. Cultivation with the plough disturbs the environmental factors which previously contributed to the maintenance of a balance between the decomposition and accumulation of organic material in the soil. Even if the quantity of organic material returned to the soil by cultivated plants should be equal to, or greater than, that derived from the natural vegetable cover, aeration of the soil as a result of ploughing will greatly accelerate the process of decomposition. Soil under cultivation therefore tends to create a new and lower equilibrum of organic material. Until this new equilibrium is reached, the accumulated humus decreases and the farmer is virtually drawing on his capital.



Millet and Cowpeas cultivated in rotation with maize.

The rate at which this process of exhaustion takes place, will depend on the system of farming practised. The new equilibrium is probably reached after 60 years or more. Depending on the climate and system of farming, this point of equilibrium may be so high that profitable farming is still possible, but it may, on the other hand, be far below the level necessary to ensure an economic livelihood on the farm. In the case of some soils in certain climatic areas, fertility may decline to below economic level within the space of a few years, with the result that the soils are then regarded as

exhausted and left uncultivated. Consequently such areas are either considered unsuitable for crop raising purposes or described as marginal crop-production areas.

In nature we therefore find a more or less definite gradation in the fertility of soils which differ in respect of the length of time that they will remain cultivatable, without marked deterioration. The most important factor determining the position of a soil in this scale is the climate. Since it not only determines the quantity of organic material which will be returned to the soil under a given system of farming and fertilizing, but also the rate at which such material will disintegrate.

Methods of Checking Deterioration.

There are three primary methods in which this normal decline in fertility due to the loss of precious organic material may be checked. The first is to stop cultivation and consequently also the rapid destruction of humus, and to build up the supply to a certain extent again by re-establishing semi-permanent vegetal cover. This method will be discussed elsewhere. The successful application of such a long-term system of rotational cropping, with a perennial crop demands: that the latter should have a value of its own, either as a pasture or hay crop; that inexpensive establishment from seed should be possible, and that it should be suited to the climatic area in question. Unfortunately, the choice of existing crops is considerably restricted by these requirements. In areas where the destruction of organic material is greatly accelerated by cultivation and soon reaches the minimum economic level, it is imperative, that the farming system should make provision for a rest period for the soil under a vegetal cover.

A second method is the addition of organic fertilizers like farm manure or compost. Depending on the rapidity of disintegration in the soil, and the amount applied, this method will in itself ensure the maintenance of a high level of soil fertility. Although this is at all times an excellent practice, which can be recommended unreservedly to farmers, its weakness lies in the fact that the ordinary crop farmer normally experiences the greatest difficulty in obtaining adequate quantities of raw material for his total manurial requirements. It is obvious that for the fertilizing of cultivated soils the raw material produced on the same soils would be inadequate both in quantity and quality: Even the attempt to attain this object would be frustrated by the costs involved.

If climatic conditions do not allow of the maintenance of a high level of fertility in spite of liberal applications of organic fertilizer, the inclusion of a perennial crop in a long-term system of crop rotation becomes essential.

A third method of checking the deterioration of soil fertility is the introduction of a suitable system of rotational cropping and, if practicable, the inclusion of a green-manuring crop. For permanent soil fertility it is only in absolutely favourable agricultural areas that this method can be applied with a fair amount of success. A sound system of crop rotation is, however, desirable for other reasons, and it is the first and also the most fundamental step in the direction of rational crop production. If rotation in itself is not sufficient to maintain the soil fertility under a given climate, it must be supplemented by the application of organic fertilizers and the inclusion of a period of rest under a semi-permanent crop.

Crop Rotation Essential for Rational Crop Production.

Although crop rotation with an annual crop is the least effective measure from the point of view of soil fertility, and will prove adequate only in exceptionally favourable areas, it is the starting point on the road to rational crop production. It makes for the elimination of soil exhaustion and destruction, diseases, insect pests and weed encroachment, declining yields, economic uncertainty, and all those pernicious features of a single-crop system. The mere rotation of crops is of little value, however, if the object is that each crop in the cycle should drain the soil of its fertility more effectively even than the previous one has done. An example of this kind of rotation is that of maize with kaffircorn or wheat with oats for grain. Crop rotation must satisfy certain requirements in order to be sound, in the sense that it promotes a sound farming.

The first requirement is that a leguminous plant should be included in the system of crop rotation. The two principle constituents of organic material are, carbon (energy material) and nitrogen (protein). A characteristic feature of every soil is that its humus shows a more or less definite relationship between these two constituents. This means that in the case of ordinary vegetable matter consisting predominantly of energy material, this portion is reduced by the activity of soil organisms, until the particular proportion is reached. Several tons of plant material are thus normally required for the formation of one ton of soil humus. This amount is lower, however, in the case of legumes with their high protein content, owing to the fact that they utilize the nitrogen in the air. It is mainly for this reason that legumes are eminently suitable for rotational cropping and green-manuring purposes.

A second requirement for sound crop rotation is that the crops used must shorten the cycle from soil back to the soil. In other words, the system must include crops which can be utilized on the farm itself, and the remains of which can be returned to the soil in the form of plant refuse, green manure or compost. This requirement finds its highest expression in the so-called practice of green manur-

Maize Yields Without Phosphate (Potchefstroom), 1931-40.

	Bags per Morgen.	Percentage of Average.	Increased Yield.
(*a*) Maize after:			
Maize continuously	15·11	88·9	—
Cow-peas ploughed in	18·38	108·1	3·27
Cow-peas cut for hay	17·13	100·8	2·02
Millet ploughed in	17·54	103·2	2·43
Sunn hemp ploughed in	16·84	99·1	1·73
Average	17·00	100·0	—
Least significant difference	0·80	4·7	—
(*b*) In a 4-year crop rotation (1932–40).			
Maize after:			
Maize continuously	14·44	88·8	—
First year after cow-peas for hay	17·95	110·4	2·51
Second year after cow-peas for hay	16·39	100·8	1·95
Average	16·26	100·0	—
Least significant difference	0·70	4·3	—

ing, where one of the rotational crops, usually a legume, is ploughed under whole in order to fertilize the soil for the succeeding main crop. Although this method of fertilizing soil dates back to antiquity, the complete desirability of this practice has by no means been definitely established since the effects of green manuring will vary according to climate, soil and the particular farming system. The table below clearly indicates, for example, that at Potchefstroom the cultivation of a summer legume as green manure for maize is not profitable since the financial gain resulting from the higher yield was off-set by the loss suffered owing to the fact that a maize crop on that soil had to be sacrificed.

The results are different, however, where het green-manuring crop does not compete directly with the main crop. An example in question is of sunn hemp as green manure for wheat in the irrigation farming of the Transvaal. Not only are these two crops supplementary in so far as soil covering is concerned, but the favourable effect is so considerable that this practice is fully justified there. In practice, therefore, green manuring will have to satisfy its own series of requirements, the most important of which are, that it must increase the ensuing crop to such an extent that its application will be profitable, that it must not compete with the main crops for soil, and that it must be suited to the particular area.

The effect on soils of a legume of which only the subteranean portion is ploughed under in rotation with a grain crop, is virtually the same as that of green manure. The difference is merely one of degree (see above table). Furthermore, if such a rotational crop could, for example, be utilized as grazing and so have its own intrinsic value, it might have an effect on the soil comparable with that of green manure or organic fertilizer. The most economic effect of the rotational crop is, therefore, also closely bound up with the prevailing farming system.

In addition to these two main requirements in respect of a rotational crop, there are others which are primarily of a practical nature, the most important being (*a*) the elimination of labour peaks, competition with the main crop for soil and losses due to susceptibility to the same diseases and pests, (*b*) high weed-suppressing capacity, and (*c*) a high succession value. By the latter is meant the effect of one crop on the next, irrespective of its influence on soil fertility. Although there are very few crops which attain this ideal in all respects, some are nevertheless better than others. The limited choice of suitable rotational crops is, however, a serious obstacle to the introduction of an effective system of crop rotation in our most important crop production areas.

It may therefore be stated in conclusion that the mere alternation of crops will very seldom prove adequate for the maintenance of soil fertility but that it constitutes a key practice which is indispensable for the proper evolution of those farming systems and practices, the collective applications of which is essential in our most important crop raising areas if a permanent system agriculture is to be developed.

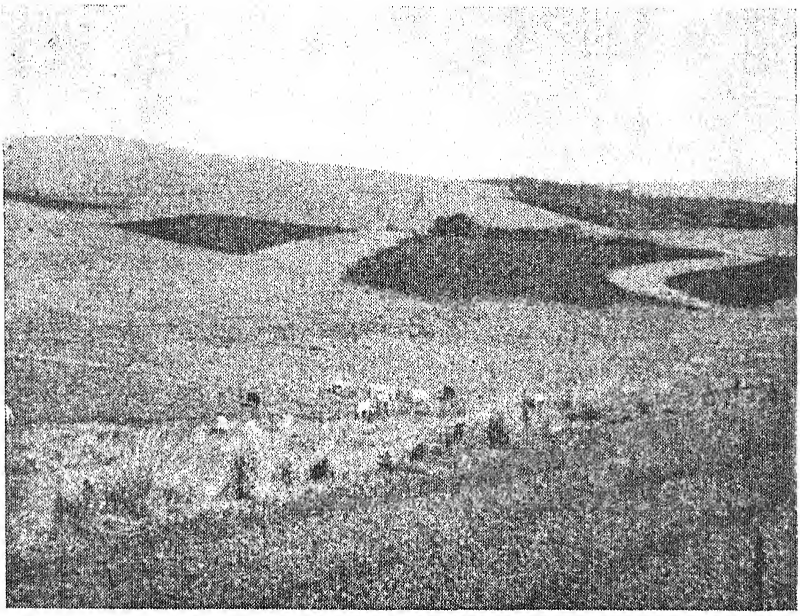
A Popular Bulletin for the Farmer.

Bulletin 234.—" Re-inforced Circular Reservoirs ", obtainable from the Editor, Department of Agriculture and Forestry, Pretoria, at 3d. per copy.

Pastures for Soil Fertility.

Dr. John Fisher, Principal, College of Agriculture, Cedara.

NATURE banks on permanent pastures for the maintenance of the soil. These pastures are broadcasted and there are no row crops in Nature's cropping system. There are no single crops, but mixtures—largely grasses, but also some legumes and other miscellaneous plants. They are not annuals, but perennials, and many of them long-lived. The plant food in the soil, the climate and the soil's physical structure make a trio which always works together in the production of crops from the soil.



Grass Strips on the contour to protect lands against erosion.

Under Nature's regime there is no ploughing; no row cropping, no artificial fertilizer. There is a definite cycle of growth and decay, each year seeing a return of leaves, stems, etc., to the soil.

When man intervenes, a whole set of changes is brought about. Whilst Nature maintains the continuity of the soil from the surface downwards, and has developed in that soil the cracks and fissures which are characteristic of the soil formed from the different rocks and which serve for root penetration, drainage and aeration—under man's manipulation these are all changed.

Soil Fertility.

Fertility is not only dependent upon the amount of plant food in an available condition in the soil, or on the physical characters or texture of the soil, but on a combination of these, together with the right macroscopic and microscopic fauna and flora. Hence it is a very complex matter, subject to the interaction of very many factors. The climate itself, with the wet summers, dry winters, or wet winters, dry summers, and the soil temperatures experienced during the seasons, plays an important rôle.

In tropical or semi-tropical soils it is almost impossible to build up fertility to the stage which can be attained in temperate to arctic climes. Decay of organic compounds is so rapid that in well aerated soils, such as soils that are frequently ploughed and cultivated, no accumulation of organic matter can take place.

It is a mistaken idea that large reserves of plant food can be accumulated in semi-tropical soils by the addition of organic manures, composts, green manuring, etc., under arable conditions. All that can be expected is a rapid oxidation of the organic matter and a setting free of the plant-food constituents contained in the vegetable material. Fertility results from building up and breaking down, not building up alone. But where constant cultivation is taking place there is a very severe wear and tear on the soil. Man directs his energies and those of his draft animals, greatly accelerated when mechanical transport enters the field, to the breaking down of the structure of the soil as built up by Nature. He breaks the continuity of the soil from the surface downwards; he causes the ploughed furrow to lie like an unconformity on the subsoil, with no cohesion, continuity or other factor to prevent it being removed from its place. Erosion in the first place only proceeds to the depth of the ploughed furrow.

The virgin furrow slice is a continuous strip of soil from one end of a field to the other: it is held together by plant roots, it has a sward, it consists of soil particles or lumps of very different sizes which favour the ingress of rains and which do not favour erosion. Erosion occurs when fertility is reduced and physical soil characters are destroyed until the soil is reduced to an impalpable powder.

Permanent Pasture.

Man, in all the cutural operations which he carries out, works directly against Nature. Land which has been ploughed for years loses fertility and physical character, and, sooner or later, sooner in the majority of cases, is useless for further arable work. Land which has been reduced to such a condition is not suitable for permanent pastures. Pastures can remake soil in its physical characters as well as from a fertility viewpoint. Yet, lands are often worked until they reach a condition of impossibility from a pasture aspect.

Permanent pastures are the life blood of a rotative system of crop production, but they must be introduced before the patient is so anaemic that it is hopeless. Lands should be in permanent pasture for as long as they are cultivated. If a field has been cropped for five years it should, whenever possible, be put down to pasture for five years. A couple of years under permanent grass cannot undo, cannot rebuild, the harm done under 8-10 years' constant cropping. What then can we expect pastures to do? We expect them to reverse all the evil that the plough does, and that in a practical, scientific and economic manner.

Permanent pastures build soil volume. They act as the shock absorber of the soil, taking the force of the tropical storms that would otherwise pound and erode the soil. They allow the rain, its force spent, to enter the soil so that there is no run off. They preserve the water in the soil, and so the deepening of the soil can continue. Pastures keep soils cool.

Under permanent pastures the soil gradually solidifies. The aeration of the soil becomes less. and with the tramping of stock

the surface becomes very firm which favours the dense fibrous root formation of the grasses.

Under a pasture regime liquid and solid excreta from stock are returned directly to the soil without loss. With this solidifying process, the soil begins to rebuild the physical characteristics which it had in the virgin state. Vertical cracks, horizontal fissures, connecting openings from one to the other are formed again. Roots penetrate these and act as the wicks to carry the water into the soil. One or two years are not enough to enable these improvements in the physical characters to be observed. The plough, harrow, etc., can destroy physical condition much quicker than pastures can rebuild it. So the statement that the soil should be as long under grass as it is under the plough is an understatement of what is desired.

The concept of a permanent pasture is one which is established while the soil is in good heart; which has been regularly and adequately, and scientifically fertilized and top-dressed; which has been balanced with the animal factor on it, and which has been scientifically managed.

Such pasture land rebuilds and remakes the soil which cultivations have destroyed. Pastures of themselves cannot add phosphates, potash and lime to the soil. These can only come from the soil itself, or from the fertilizer bag. If the soil has been impoverished by cropping, very liberal applications will be necessary.

Nitrogen.

The nitrogen problem falls into a different category. If the soil has not been too impoverished as regards phosphates, potash and lime, it is possible to introduce inoculated legumes into such pasture, along with the grasses of the pasture. Pastures make larger demands on nitrogen than crops in arable soil do, and hence the imperativeness of the need for the legume to be well inoculated.

In temperate climes the high-quality mark of a pasture is perennial rye grass and wild white clover. These are both excellent grazing plants, suitable for their purpose, but demanding high class farming to keep them. Less than 2 per cent. of the pastures in Britain recently came under this category.

Very high class pastures are balanced with very intensive stock. The dairy cow in full flow of milk, the ewe suckling a lamb or two lambs for the milk-lamb trade, the mare with foal at foot, these are the animals that should be seen on high class pastures. The other class of livestock which is in the same category is young calves just being weaned from a milk diet.

All these animals remove milk, and milk contains three times as much nitrogen as phosphoric acid. Pastures, therefore, must be well fertilized with nitrogenous fertilizers or they must have a 30 to 40 per cent. of total herbage made up of leguminous plants well inoculated. If pastures fail in this respect they are going to fail also in their ability to maintain their role of keeping up the soil fertility. This is a very important point.

Worn-out soils, carrying feeble growths of sickly-looking grasses, cannot play a rôle of any importance. Nature, as soon as the problem is left to her, will heal the wounds made by man, but centuries will need to elapse before such land can come back into an arable pasture sequence.

Fertilizers for Pastures.

The questions which demands an answer is: When these lands are depleted of phosphates, as they tend to be, can the restorative legumes be induced to grow in the pastures without first raising the available phosphoric-acid content? The reply is: A problem cannot be solved by treating the effect, but by removing the cause. If the cause is a loss of physical soil characters and phosphoric acid, then these must be replaced by the return of phosphoric acid and re-establishment of the physical soil characters. The scientific management of the pastures in this rotation of pastures and arable crops means correct stocking, rotative grazing, the correct and timely use of the mowing machine and correct fertilizing. Considerably more fertilizer can be applied to a good pasture than is ever given to our ordinary cereal crops and this should contain quite a large percentage of nitrogen. *Mixtures H. or G.* of our present-day mixtures are the only ones suitable for pastures.

After the sward has been established for a few years the accumulation of organic matter and the action of the associated humus, organic acids, etc., responsible for the crumbly soil structure, as well as the amount of plant food rendered available, such pasture can then be returned to arable crop production without fear of any ill-effects and with every assurance of beneficial results to follow.

A Future Policy.

Whilst the policy in the past has been to plough up good grass land to use the same for arable crops, the future policy must be to put down good arable land to pasture to make it better from every point of view.

At the present moment one of the largest demonstrations ever carried out in the whole wide world is being shown in Britain. Grass lands, totalling millions of acres, has been returned to the plough, with wonderfull results. After a three-year course of cereal growth the problem now presenting itself is one of the temporary ley for 2-3 years in the rotation. Such a temporary ley is found in the Italian rye grass-red clover, sown on wheat in the spring and taking over the soil when the wheat is harvested.

South African agriculture badly needs temporary leys as well as more permanent pastures in its farming, building up systems scientifically correct, instead of the haphazard, no system, so frequently seen. The working out of the best ley is a work of great importance and its value cannot be too highly stressed for the future benefit of all our arable soils.

Maintenance of Soil Fertility In Spite of a Fertilizer Shortage.

A. Marais, Division of Chemical Services.

NEVER before have our farmers realized the importance of phosphates, whether in the form of fertilizer or of bonemeal, more acutely than at the present time when a serious shortage of both is being experienced by the farming industry in animal as well as crop production.

According to the returns submitted by about 45,000 farmers in regard to their fertilizer requirements for 1943, it appears that this year's demand for phosphatic fertilizer in the form of superphosphates amounts to approximately 400,000 tons, while the demand for animal feeds, in the form of bonemeal, has risen to about 25,000 tons.

The present shortage of phosphatic fertilizer will therefore undoubtedly have a hampering effect on animal and crop production, but the use of phosphate is not necessarily the only method of maintaining soil fertility at a high level. Many farmers have already realized for some time that maximum yields cannot be obtained with the use of phosphates only, and have endeavoured to remedy the situation by supplementing superphosphate with animal manure or compost. In fact, many have even realized the expediency of using mixed fertilizers, particularly under intensive cultivation, while at the same time applying an effective system of rotational cropping in which a suitable legume plays an important rôle.

Agricultural Lime.

As a result of the regular application of superphosphate over a number of years some of the older agricultural soils must undoubtedly have a fairly high accumulation of phosphates so that there will certainly be cases where soils have retained sufficient phosphate for the production, for one season at least, of a reasonable crop without the application of phosphate. Such soils will, however, be the exception rather than the rule, since so many of our soils, owing to their acidity, i.e. deficiency of free lime and, more particularly, owing to the presence of appreciable quantities of iron and aluminium convert a considerable portion of the superphosphate applied into a form which is virtually unavailable to the plant. In such cases it may pay the farmer, purely as a temporary and emergency expedient, to give such soils a good application of agricultural lime, not because lime is a plant nutrient which can take the place of phosphates, but because it might at least make available to the plant a portion of the phosphates which have been applied in the past and which have now entered into unavailable combinations with iron and aluminium.

If lime is to have a favourable effect in this direction it will be of little or no avail to apply only a few bags of agricultural lime per morgen with a maize or wheat planter, but agricultural lime of good quality must be broadcast and ploughed under at least a month or more before the main crop, at the rate of one or two tons per morgen, according to the acidity of the soil and the nature of the climate and rainfall. Such an application should always be followed by a crop like tobacco or lucerne and other legumes which are likely to derive the greatest benefit from it.

Weed Control.

There can be little doubt that a larger percentage of the valuable phosphates applied to our agricultural soils is used by weeds instead of by the crops for which they were specifically intended. Conclusive proof of this statement is to be found in the results obtained at the Summer Cereal Station near Kroonstad, where maize lands which were not treated with fertilizer but which were thoroughly cultivated and regularly weeded, yielded an average of 18 bags per morgen over a period of 12 years, which is appreciably higher than the average yield for that district namely, 8 bags per morgen, or for the whole Union. If, therefore, maize lands are kept as free as possible from weeds the country as a whole will undoubtedly derive relatively greater benefit from the limited quantities of fertilizer available than it does in normal years when applications are adequate, but weed control is not effective.

Every farmer who this year receives only about 50 lb. of superphosphate per morgen for maize, which is on an average about one-quarter of his normal requirements, will therefore have to solve the problem of how to use this small quantity of fertilizer in the most effective manner without unnecessarily lowering the fertility of his soil. The prudent farmer will take the natural fertility of his his soil into account, and may feel that he should use the available fertilizer on only a quarter of his lands. Another farmer may consider that the condition of his soil allows him to limit fertilizer treatment to half the normal area, so that lands treated will at least receive 100 lb. per morgen. Yet another farmer may find that even under normal conditions his fertilizer requirements do not exceed 50 lb. per morgen and his usual applications will therefore remain unaltered. Many farmers, however, who have already taken advantage of the favourable rains during the past winter and who have already ploughed the normal area for maize, will be confronted with the problem of what to do with the remaining ploughed lands for which there is definitely no fertilizer.

Legumes.

In view of the relatively high prices for maize and kaffircorn, many farmers will risk planting these two crops without fertilizer on the lands already ploughed rather than leave the lands to lie fallow since it is well known that kaffircorn in particular is able to produce a fairly good yield on poor soil. The same also applies to sunflower and teff. Unfortunately, however, farmers seem to overlook the fact that such crops are inclined to exhaust soil very seriously. If, therefore, it becomes a general policy this year to plant such crops on all available arable lands without fertilizer, many of our best soils will be impoverished to a very serious extent and may even become so exhausted that when fertilizers are plentiful once again it will be impossible even with the assistance of artificial fertilizer, to obtain a normal maize crop from the soil for several years. Legumes, on the other hand, although they also require phosphates, have by no means such an exhaustive effect on the soil as, for example, maize, kaffircorn, teff or sunflower. In fact, they even improve the soil by enriching it with nitrogen which is obtained from the air, and which stimulates growth. Moreover since legumes generally have an entirely different root system from the above-mentioned crops, they obtain plant nutrients from the deeper layers of soil, with the result that their root remains benefit subsequent crops.

The reduced fertilizer allotments for this year must inevitably result in a smaller maize and wheat crop next year, not to mention the smaller supply of animal feed. Meat, eggs and dairy products may also be scarce. The production of larger quantities of beans for human consumption can contribute in no small measure towards supplementing the shortage of protein foods. In addition, the large quantities of legume hay which such a course would make available, will prove invaluable as stock feed. If, therefore in view of the above, farmers rather plant their surplus lands for which they have no fertilizer, or part of them at any rate, to beans and especially cow peas, the loss of soil fertility will be less, while man, stock and the country as a whole, will benefit.

Soil Erosion.

In many parts of our country, exploitational cropping, whether this be due to injudicious methods of cultivation or to insufficient fertilizer, is unfortunately not the only cause of the slow but sure loss of soil fertility. In many cases it can be ascribed to the destruction of the valuable humus and organic material which have such a beneficial effect on soils. There are, however, numerous cases where farmers maintain that 15-20 years ago their soils gave very much better yields without fertilizer than is at present possible even with their assistance and with improved methods of soil cultivation Although these complaints are often ascribed to a supposedly deleterious effect of fertilizer, particularly superphosphate, a careful investigation usually sheds an entirely different light on the matter. A striking feature is that such cases almost invariably occur in the high-rainfall areas of the country, particularly in those parts where lands lie against a slight slope. With the very first heavy showers after the soil has been ploughed, sown and harrowed, but before the crops have developed sufficiently to cover the soil and bind it with their roots, dongas are formed in such lands, and a considerable portion of the fertile topsoil is washed away, as is evidenced by the red streams of water and rivers which in rainy seasons flow from such regions to the sea, carrying with them the fertile topsoil, together with an appreciable portion of the fertilizer which has been applied.

This surface erosion is unfortunately such a gradual and imperceptible process that permanent inhabitants of the area seldom become aware of the serious threat to their existence until patches of yellow subsoil appear in lands which formerly had a dark colour and the extremely poor crops, in spite of heavy applications of fertilizer, make further cultivation of such lands uneconomic. When the farmer wakes up to what is happening, it is often too late and he has little more than the raw subsoil left. Although this damage can be caused within a comparatively short period, it may take more than a life-time to restore the soil to a profitable level of fertility. A very regrettable aspect of the matter, however, is the fact that although the Government is doing everything in its power to obtain valuable shipping space for the importation from overseas of the even more valuable rock phosphate, many farmers who cannot even make a living without this phosphate, year after year allow some of it to be washed away to the sea, together with their precious and practically irreplaceable topsoil.

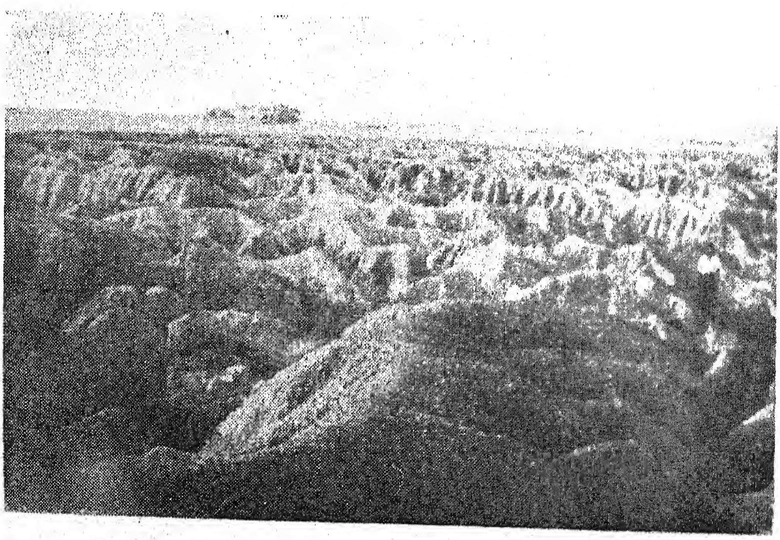
Contour Embankments.

It is within the means of every farmer, however, to check and to put a stop to this menace, thanks to the liberal financial and

other assistance which the Government has now for several years placed at the disposal of all farmers who are prepared to control erosion of this nature by constructing contour embankments. Farmers are assisted in constructing such contour embankments by means of a subsidy covering one-third of the estimated costs and can enlist the aid of experts for surveying such embankments and for furnishing the necessary advice.

Owing to the serious shortage of fertilizer this year, the Controller of Fertilizers has already been obliged in allotting the available fertilizer supplies to give preference to areas where certain crops produce much surer and more regular yields with the aid of fertilizer than in other marginal areas. If the present fertilizer shortage lasts much longer, the possibility exists that serious consideration might be given to the question whether, in the interests of the country as a whole, it is advisable to continue allotting part of the small quantity of fertilizer still available to farmers who neglect to take the necessary steps to prevent their soil from being washed away.

Apart from applying the above measures to maintain soil fertility at the highest possible level under the present circumstances, every farmer can also greatly assist in alleviating the fertilizer shortage by starting an anti-waste campaign in his own interest. Full use can for example, be made of all waste products on the farm, by converting organic matter like straw, grass, weeds and also wood ash into valuable compost with which to supplement fertilizers.

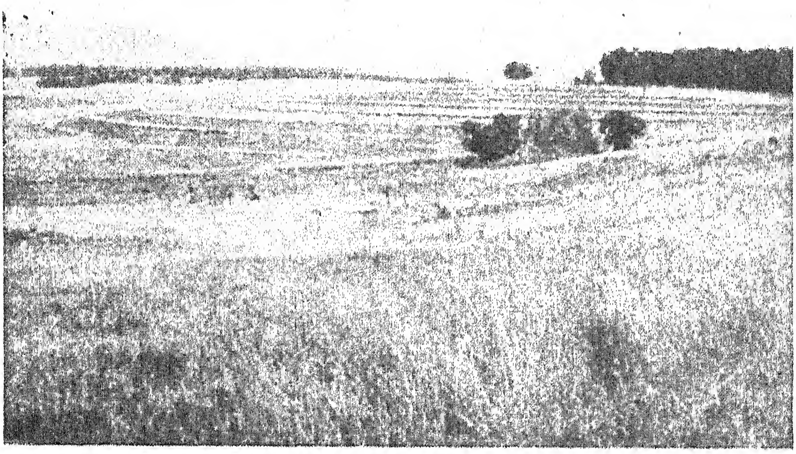


What Erosion can do.

Safeguarding Lands Against Erosion.

Dr. J. C. Fick, Principal Professional Officer, Division of Soil and Veld Conservation.

THERE is no substitute for soil for the production of crops nor can anything else be substituted for the water which the latter require. For this reason the soil should be preserved in good condition, and its plant nutrient content and structure maintained and improved. The maintenance of the good natural structure is most important, especially because rainwater can then be readily and rapidly absorbed. Under our climatic conditions it is of vital



Arable lands along the contour.

importance that rainwater should be conserved and that as little as possible should be allowed to be swept to the sea or lost in other ways. Cultivated lands can continue to produce and their productive capacity may even be increased if the soil is not neglected or water allowed to go to waste, but if this is the case the nutrient productivity of the soil will decline until it reaches a level when crop production will no longer be profitable.

Everywhere striking examples may be seen of lands which once yielded excellent crops, but which are now useless because the vital surface soil on which their productive capacity depended, has been exhausted or allowed to become prey to wind and water erosion. Many other lands are rapidly heading for the same fate. We cannot afford to allow more soil to become impoverished or to be completely ruined. This need not happen, however, if judicious methods of crop production are practised and measures to combat erosion are applied.

Contour Farming.

In addition to appropriate methods of crop production and soil conservation discussed in this issue, other measures must sometimes

be taken to safeguard sloping lands against erosion. The first step in this direction is to plough and plant along the contour and not downhill since the latter procedure results in the formation of numerous channels facilitating the rapid run-off of water which should sink into the soil, with the result that the fine top soil is swept away. This is especially the case with row crops like maize, where the parallel furrows made by the cultivator form excellent channels for run-off water.

Although contour ploughing will help considerably in the conservation of soil and water, this alone is not sufficient, since something must still be done to protect the lands against heavy downpours. A further step is necessary, namely, the construction of contour banks and furrows. The underlying idea of this procedure is to interrupt the long incline and to divide it up into shorter slopes, each of which will then have to deal only with the water falling on its own area, and not with all the extra water discharged from the higher levels. This breaking up of a long slope is accomplished by constructing contour embankments, or rather banks with a slight fall at definite intervals. The soil for these banks is usually taken from the upper side, so that a furrow or channel is formed along which surplus water can be conducted to the side of the bank, and then discharged at a suitable point. During heavy downpours channels are eroded in sloping lands and a considerable quantity of soil is lost. If, therefore, the volume of water which would otherwise run down the slope very rapidly, is broken up in this way, checked in its speed, or conducted at a slower rate along the contour of the land, its scouring effect is greatly reduced, and the possibility of a gradual removal of the precious topsoil is practically eliminated.

In cases where flood water is discharged on to the lands from higher levels, it must also be diverted along banks before reaching the lands.

The spacing of these banks depends primarily upon the angle of the slope and kind of soil. In surveying a system of contour banks, a vertical fall of 6 ft. between successive contours is usually allowed. It is impossible, however, to discuss in this article all the details in regard to the lay out, size and type of banks, width of channels, methods of construction and the implements to be used. Such information is obtainable from the Department of Agriculture and Forestry, which will even send an officer to survey the banks and to give the farmer advice.

Strips of Grass between Lands.

Where virgin soil is ploughed for the production of crops, future trouble and loss can be avoided by immediately laying out the lands along the contour, and leaving unploughed strips of veld from 9 to 15 ft. wide between them. These strips serve to check the force of the water, especially since the grass cannot be grazed during the rainy and growing season and, consequently, grows luxuriantly. Water will even be conducted along these strips of grass, which gradually catch up soil with the result that their level will be raised in course of time until they also form natural embankments.

It is also a good plan to plant contour grass strips on lands which have already been ploughed in one block. Excellent results have been obtained with elephant grass. In areas where this or a similar kind of grass grows well it may even be used in preference to embankments.

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What Sort of Manure*?

Dr. J. P. van Zyl, Controller of Fertilizers and Chief, Division of Chemical Services.

"WITH what must I manure or fertilize my soil? ", is a question which is frequently asked, especially in the present circumstances. A few ideas in this connection would, therefore, not be out of place.

The old saying that " manure is the farmer's mainstay " is still very true to-day. The fact that manure has been used for agricultural purposes since time immemorial has been established by historians. The most classical example is perhaps that of the Chinese farmer who, as far back as 4,000 years ago, practised methods of manure conservation and utilization which are almost comparable with the best methods of to-day. The Chinese farmer of long ago fully appreciated the necessity for giving the soil, which was expected to provide regular crops for the maintenance of his family and animals, the care it deserved, and accordingly applied manure. There have been periods in history, however, when farmers have shown a strong tendency to practise exploitational cropping, that is, to cultivate crops on a piece of land as long as good yields were obtained and then simply to abandon it before repeating the process on fresh soil. In a country like South Africa, where the farms are extensive, this tendency frequently manifests itself, and we all know of cases where continuous cropping without the application of manure has so exhausted the soil that the cultivation of crops has had to be abandoned. Although an uninitiated person glancing through the thousands of applications for fertilizer would probably gain the impression that in no country in the world are farmers so " fertilizer-conscious " as in South Africa, there are, unfortunately, many farmers who still persist in treating their lands in a very step-motherly fashion.

What exactly does the word " *manure* " denote? It can really be regarded as a specific agricultural term and usually means the animal excreta or stable refuse used for applying to the soil to improve crop growth on it. Frequently the word is given a far wider application, so that it may include all manner of farmyard refuse that may be added to cultivated soil, *inter alia* the article more specifically known as " compost " or " artificial farmyard manure " which is usually prepared from chaff, straw, leaves and waste plant matter with or without the addition of a little animal manure. The Afrikaans-speaking farmer often uses the word " mis ", the equivalent of the English term " manure ", to include such chemical substances as superphosphate or ammonium sulphate, and one may find an occasional English-speaking farmer who uses the word manure in this sense. For practical purposes it is, however, recommended that the latter two " manurial substances " should preferable be given separate names. The term *fertilizer* should be used for the mineral substance such as superphosphate, potassium salts, chile saltpetre and ammonium sulphate, which are utilized as plant nutrients, whilst *compost* would be a more appropriate name for the product obtained as a result of the distintegration of miscellaneous plant residues (even is a small quantity of animal manure is present).

* The term " manure " is here used in the sense of the Afrikaans word " mis " to include " dung ", " manure " and " fertilizer ".

The Use and Nature of Manuring.

Ever since modern chemical science took definite shape, there have been controversies regarding the usefulness, purpose and nature of manures and fertilizers. For many years, till about 1840, scientists were more or less agreed that the most important functions of manuring the soil were to supply the plant with carbon and to improve the physical condition of the soil so as to make it more favourable for plant growth, although even before that time certain scientists had begun to emphasize the value of certain mineral substances as plant food.

Round about 1830 the young German scientist, von Liebig, elaborated and advocated the revolutionary theory that the main purpose of manuring was merely to provide plants with certain mineral nutrients and that the organic material which had hitherto been almost the sole type of "fertilizer" used, was beneficial only in so far as it contained certain plant nutrients. This theory was gradually accepted and there followed a period when mineral fertilizers were all the vogue. During the past 25 years, however, the old theory that organic substances fulfil a special function, quite apart from their ability to provide plant nutrients, has once again gained prominence. It is not possible to enlarge here on the many interesting views and developments; suffice it to say that there are two sides to every question. Those who maintain that farmers would be best advised under all circumstances to use the organic substances like kraal manure and compost err just as much as those who recommend the sole use of artificial fertilizers. There are advantages as well as disadvantages attached to the use of both classes of substances, and the modern farmer must learn to use both if he wishes to obtain optimum yields and at the same time build up the fertility of the soil. In many parts of this country the soil is so seriously deficient in phosphate that failure to supplement the phosphate content, over and above what can be achieved by means of compost applications, would be sheer folly. On the other hand, there are many cases, e.g., vegetable production, where really good results are possible only if large quantities of good kraal manure are applied. Research work carried out during the past decade or so, also seems to indicate that one of the best methods of rejuvenating "exhausted" soil in high-rainfall areas is to grow a permanent grass variety on it for a few years, when the mass of fine roots penetrates the soil in all directions and revitalizes it.

Effect of Organic Substances.

From the foregoing it should be clear that the value of manure should not be judged merely by the quantities of the well-known plant nutrients, nitrogen, phosphate and potash which it contains. These are, admittedly, of very great importance, but there are also other equally important factors. "Manure" which contains a high percentage of organic material frequently has an exceptionally beneficial effect on the aeration, moisture distribution and bacterial life in the soil, all of which are factors of considerable importance in maintaining the fertility and good qualities of a soil. A great deal is also heard these days about the importance to plant growth of the so-called "trace elements", i.e., substances such as, for example, boron, copper, etc., which have a stimulating or tonic effect. Such substances are likely to occur in larger quantities and in greater variety in compost and farm manure than in artificial fertilizers, and it is on this account that some agriculturists claim that more

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Fertility of Wheat Soils in the Western Cape Province.

M. H. Slabber, Professional Officer Agricultural Chemistry, and J. T. R. Sim, Professor in Field Husbandry, Stellenbosch-Elsenburg College of Agriculture.

THE most important wheat-growing regions of the western Cape Province are the Swartland (Malmesbury) and the Rûens of Caledon-Bredasdorp. The soils of these two regions differ in some important respects, consequently they are discussed separately.

The Swartland Soils.

The largest and by far the most important group of soils in the Swartland is derived from Malmesbury shales. The outstanding characteristics of these soils are their shallowness and, as shown in Table 1, their low phosphate and nitrogen content, fairly acid reaction and poor nitrification.

Table I.—*Average percentage composition of soil from the Swartland area (60 samples).*

Coarse Sand.	Fine Sand.	Silt and Clay.	pH	Nitrogen (N).	Phosphoric Oxide (P_2O_5).	Potash (K_2O).
					(Soluble in 1%	citric acid.)
42·3	42·1	15·6	5·6	0·059	0·0028	0·007

These soils further tend to cake after heavy rains, a condition attributable mainly to the high " fine sand " fraction and low organic-matter content. In some years the yields may be greatly depressed by this cause, especially if heavy rains occur after sowing but before the young seedlings have appeared, followed by dry weather. The surface then develops a very hard crust through which the seedlings penetrate with difficulty, if at all. Harrowing is often done to break the crust and allow the seedlings to emerge, but there is always the danger that a heavy downpour immediately after harrowing may result in still worse caking than before.

The available *phosphate content* of the soil (even in the virgin state) is very low. In soils which have been liberally fertilized with phosphate during the past 30 years, the available phosphate content is decidedly on a higher level, but it is still small in relation to the quantities of fertilizer applied. This condition is mainly due to the high iron and aluminium content of the soil which, coupled with an acid soil reaction, induces a very strong reversion of the soluble phosphates to insoluble and unavailable forms.

The *nitrogen content* of the soil is also very low, and frequently insufficient attention is paid to this weakness. In fact the increased yields resulting from application of phosphates, especially on newer soils, have virtually induced a phosphate complex among growers, with the result that the significance of the seriously depleted nitrogen reserves of the soil has not been fully realized. The soils give a definite positive response to phosphatic fertilizers, but likewise they show a very marked response to nitrogenous fertilizers. That farmers are starting to realize that phosphate alone is insufficient for this area, and that nitrogen is required as well, is revealed in the increased use now being made of compounded *mixed fertilizers.*

Attention must also be drawn to the fact that farmers frequently apply very heavy dressings of mixtures containing a small amount of nitrogen, when much lighter dressings of mixtures containing a higher percentage of nitrogen would answer just as well, and be more economical.

The *potash content* of the soils is generally on a satisfactory level, the subsoil even better supplied than the surface soil, and heavy crops can be taken for many years to come before it will be necessary to apply potash fertilizers.

The *organic-matter content* of the soil is at a dangerously low level. Even in virgin soil the amount is on the small side, and under the mild winter conditions of this area there is a rapid destruction of organic matter during the first few years after the soil is brought under cultivation. Thereafter the tempo of this process decreases as the organic-matter content diminishes, and it would appear as if in the long run the organic-matter content of soil under cultivation reaches a more or less fixed level below which it does not drop, depending of course upon the soil type and the farming practice.

Analyses of contiguous grain lands, one 60 years under cultivation, the other 25 years under cultivation, compared with the analysis of adjacent soil never under the plough, have revealed that the cultivated soils have both lost about 60 per cent. of their original organic matter. The fact that these two soils cultivated for different lengths of time differ very little in their present organic-matter content, indicates that both have reached their bottom level of organic matter, and it would be incorrect to think of a total destruction of organic matter in these soils.

The influence of organic matter, as humus, is so profound, however, that a loss of 60 per cent. of the original small but invaluable amount of organic matter introduces a state of instability with most dangerous consequences for successful wheat production. Ways and means must therefore be found not only to maintain, but also to improve the organic matter reserves in these grain soils.

The *soil reaction* or the acidity of the soil in the Swartland is generally just within the limits favourable for wheat, but it is sufficiently low to call for the more extensive use of agricultural lime and the application of phosphates, in the basic form, i.e., basic supers, basic slag, rock-super mixtures, etc. Such a policy is of fundamental importance for it permits of the best utilization of the phosphate added, it creates more favourable conditions for building up available phosphate reserves, and it sweetens up the soil so that legumes can be incorporated successfully in the rotation.

At the Langgewens Experiment Station, Malmesbury, it has been found that the *cultivation of fallow land (braakland)* in spring (September-October) induces an average increase in yield of approximately 30 per cent.* The cause of this marked increase is thought to be extra nitrification resulting from aeration of the moist soil under favourable temperature conditions. If this opinion is correct, it means that the increased yields are being obtained at the cost of the already weak organic-matter reserves. It is therefore essential that the spring cultivation should be preceded by the incorporation of organic matter into the soil, so that the augmented yields may be obtained without impairment of the organic-matter reserves in the soil.

Fertilizer recommendation for the Swartland.—Based on much experimentation over a number of years, and on many soil analyses,

*See also "The Cultivation of Winter Cereals" by P. D. Henning, *Farming in S.A.*, March, 1943.

it would appear that the most economical quantities of phosphate and nitrogen per morgen for the Swartland in general are 56 lb. P_2O_5 and 24 lb. nitrogen, which can be applied as 350 lb. superphosphate (16 per cent.) or its equivalent in basic form, and 120 lb. sulphate of ammonia per morgen.

The Caledon-Bredasdorp Rûens Soils.

Practically all the soils in this area are derived from Bokkeveld shales. In some respects these soils have characteristics in common with those of the Swartland, e.g., they are shallow, poor in phosphate content, and well supplied with potash. They differ from the Swartland soils, however, in that they possess a higher content of organic matter and of nitrogen, and a more favourable soil reaction and mechanical composition, as shown in Table 2.

TABLE 11.—*Average percentage composition of soils of the Caledon-Bredasdorp Rûens* (40 *samples*).

Coarse Sand.	Fine Sand.	Silt and Clay.	pH	Nitrogen (N).	Phosphoric Oxide (P_2O_5).	Potash (K_2O).
					(Soluble in 1%	citric acid.)
20·9	33·4	45·7	5·99	0·146	0·002	0·016

Owing to the fair content of organic matter and nitrogen in the virgin soils, there is no response to nitrogenous fertilizers during the first few years of cultivation. The older cultivated soils, however, show the same deterioration in fertility as is observed in the Swartland soils. The initial higher organic-matter content apparently stretches the period of declining fertility, and especially of organic-matter destruction, over a long time.

Taking everything into consideration there is no doubt that effective application of phosphatic fertilizers is the mainstay of economic production on these soils. But it must be realized that superphosphate alone cannot easily build up phosphate reserves in the soil. A more effective phosphate treatment is that of using superphosphate in combination with raw rock-phosphate. Good results have already been obtained on these soils by the use of such mixtures, and they can be recommended, especially in rotations including legumes such as lucerne. At the same time the use of such mixtures will allow phosphate reserves to be built up more rapidly.

Fertilizer recommendation for the Caledon-Bredasdorp Rûens.—Based on experimentation and on analyses the optimum fertilizer treatment appears to be a dressing of 450 lb. (16 per cent.) superphosphate (i.e., 72 lb. P_2O_5) per morgen. When raw rock-super mixtures again become available, a dressing of the mixture at the same rate as for 16 per cent. superphosphate can replace the pure superphosphate dressing.

On relatively new soils, or lands which have carried dryland lucerne, no nitrogen need be given. On older lands the optimal amount of nitrogenous fertilizer is approximately 60 lb. ammonium sulphate (i.e., 12 lb. N) per morgen.

The Maintenance of Organic Matter in the Grain Soils.

In spite of generous applications of artificial fertilizers the grain yields of the western Cape Province are low in comparison with those of most other countries. These low yields may be ascribed, at times,

partly to disease infection, as for example rust, or to untimely dry spells at critical periods during the wheat-plant's life, but always they are partly, if not mainly, due to the depleted condition of the organic-matter reserves and the consequent poor physical condition of the soil.

As pointed out, the organic-matter content of the soils of the grain districts is at a low level, and unless the necessary steps are taken without delay to prevent further reduction of the organic-matter reserves, it will not be long before many soils become incapable of producing economic crops. The fact that yield figures published, as for example in census reports, show no appreciable diminution, does not reflect the true position. Actually the precarious condition of these soils has been masked in latter years by temporary stimulation resulting from the more efficient utilization of artificial fertilizer, from more thorough methods of soil cultivation, and to a great extent from the more general use of improved disease-resisting varieties. The true state of affairs is reflected in the great deterioration in the physical condition of the soil, as demonstrated by the development of poor soil structure, caking of the surface, poor water absorbing and retaining power, and the like.

The grain crops are classified as " humus destroying " crops, and under the prevailing wheat-fallow system the already low organic-matter reserves in the grain soils are being progressively reduced, for practically no humus (or organic matter) is being returned to the soil to compensate for that removed.

Every effort must therefore be made to bring back into the soil sufficient organic material, not only to maintain but to build up the organic-matter reserves, so that the soils may become capable of the production of really good yields.

Sources of Organic Matter.

As fully explained in a recent article in this journal(*) the sources of supply of organic matter for the soil are (1) farmyard manure, (2) crop residues such as straw and chaff, (3) compost, (4) green manures and (5) the cultivation of the so-called " humus producing " crops. In that article it was pointed out that the supplies of manure available are entirely inadequate for the extensive areas under cultivation, that the production of compost depends largely upon the available water supplies, and that green manuring is not economically practicable under the relatively dry conditions which prevail in the main grain districts.

Straw and chaff, however, are valuable sources of organic matter, and the practices of burning straw stocks and of selling chaff must be very strongly condemned. The chaff can be returned directly to the land in February-March at the rate of 1½-3 tons per morgen, and ploughed under in July. Straw or chaff can be used as bedding or in kraals, where it absorbs the urine and becomes a strawy manure. Such material can also be ploughed under in July.

When returned to the land these residues help appreciably to maintain the soil in a productive condition, as has been demonstrated by experiments at the Langgewens Experiment Station. There it was found that after four biennial applications the chaff and strawy manure both had induced an increase of about 12 per cent. over the results obtained where no chaff or strawy manure was incorporated.

Where chaff contains many seeds of undesirable weeds, such as Wild Vetch (wilde-ertjie), it is preferable that such material should

(*) *Farming in South Africa*, March 1943—" Crop Rotation in the Grain Districts ", by J. T. R. Sim.

be turned into compost or well rotted manure, the seeds being rendered innocuous thereby.

When the grain crops are harvested by "strippers" or "combines" long straw is left on the lands, which by impeding the movement of run-off water greatly reduces erosion, and when later ploughed under markedly improves the productive power of the soil.

Dryland Lucerne.

The most striking means of building up the fertility of worn out grain soils was brought to light when it was found that not only can lucerne (a "humus producing" crop) be grown successfully as a dryland crop, on the grainlands, but that grain crops grown on ploughed-over 3-4 years old lucerne lands give vastly superior yields to those obtained from grain grown on braakland, as may be illustrated by the following results obtained at Elsenburg.

On a 10-morgen field, whose normal grain yield was 9-10 bags of wheat per morgen, dryland lucerne was grown as a grazing crop for four years. Excellent grazing was obtained from May to December, and each year hay or silage cuttings were made in September-October. In May of the fourth year the lucerne was ploughed under, and the soil was worked down. Three weeks later wheat was sown with a fertilizer dressing of 400 lb. superphosphate per morgen, but no nitrogen. The crop yielded 16 bags per morgen—an increase in yield of 60 per cent. The following season the wheat stubble was ploughed over and wheat was sown again, with 400 lb. superphosphate per morgen and no nitrogen. Again the yield was 16 bags per morgen. In May of the following year the land was ploughed and oats were sown with 400 lb. superphosphate per morgen and no nitrogen fertilizer, which gave a crop of 16 bags to the morgen. During these three years the stubble grazing was excellent, for it contained a considerable number of lucerne plants.

Similarly during the 1942 season the value of dryland lucerne as a soil improver was demonstrated in the rotation experiments under very wet autumn and early winter conditions. At Elsenburg wheat following lucerne yielded 18 bags per morgen, in comparison with 5 bags per morgen from wheat grown on braakland. At Langgewens 11 bags per morgen were obtained from wheat sown on old lucerne plots, and 5 bags per morgen from wheat sown on braakland.

It is evident, therefore, that dryland lucerne as a rotation crop with grain, offers wonderful possibilities for improving the fertility of the soils of the grain areas. As a humus-producing crop it can compensate for the harm done by the humus destroying grain crops, and not only maintain but build up the productive power of the soil to higher levels. It fixes great quantities of nitrogen in the soil, and in addition the high quality grazing provided makes possible a vastly improved livestock industry.

Crop Rotation.

Details of how lucerne can be incorporated in the rotation with grain are fully discussed in the article already referred to, and it is unnecessary to repeat them here. Mention may, however, be made of the fact that with lucerne as a semi-permanent pasture crop for three to four years on the land, long-cycle rotations must be substituted for the present-day short-cycle rotations. With our present knowledge it appears that rotations such as *lucerne, lucerne, lucerne, braak, wheat, braak, oats, braak, wheat, braak, oats, braak* form the type most suitable to the drier areas, while rotations such as *lucerne,*

lucerne, lucerne, lucerne, wheat, wheat, oats, oats and rape grazing) form the type most suited to the higher rainfall reg Such examples are naturally by no means the last word on the su and as time goes on experimentation and experience will contri valuable ideas towards the final selection of the ideal type of rotatio.

There is no longer any doubt that lucerne must form an integral part of the farming systems in the grain areas, and it therefore behoves all farmers in the grain districts to get started with lucerne, for the sooner a start is made, the sooner will the farmers reap the benefits from this soil-improving crop, and the sooner will the agriculture of the grain districts rest upon a sound and solid foundation.

In conclusion the point may be stressed that for successful grain production both organic matter and artificial fertilizers have important parts to play. Neither is sufficient in itself; instead the one i complementary to the other. Artificials applied in heavy doses will not render a soil fertile if its organic matter status is poor, neither will large organic-matter reserves produce high yields unless the crop plants are adequately fed with the requisite plant-food elements, particularly nitrogen, phosphorus and potash. Further, the presence of a good supply of organic matter ensures the most efficient utilization of the plant-food elements contained in the artificial fertilizer.

What Sort of Manure?

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general use should be made of natural manure. Nevertheless, it is very doubtful whether the practice which has become increasingly common in South Africa during recent years, namely, that of applying to maize and wheat one or two bags of fine kraal or karroo manure per morgen, generally mixed with a much smaller quantity of supers, is justified. Such small applications probably do very little good, if any, for accurate experiments carried out up to the present have not revealed any favourable effects. Our agriculture as a whole would derive much greater benefit if the available supplies of natural manure and compost were used primarily for crops, like vegetables, which really react well to heavy applications thereof.

Safeguarding Lands Against Erosion:—

[Continued from page

On lands which are already so seriously eroded that sluits ha been formed, banks will be indispensable. Grass can be planted such banks. In any case, it is wise to stabilize all embankmen with grass.

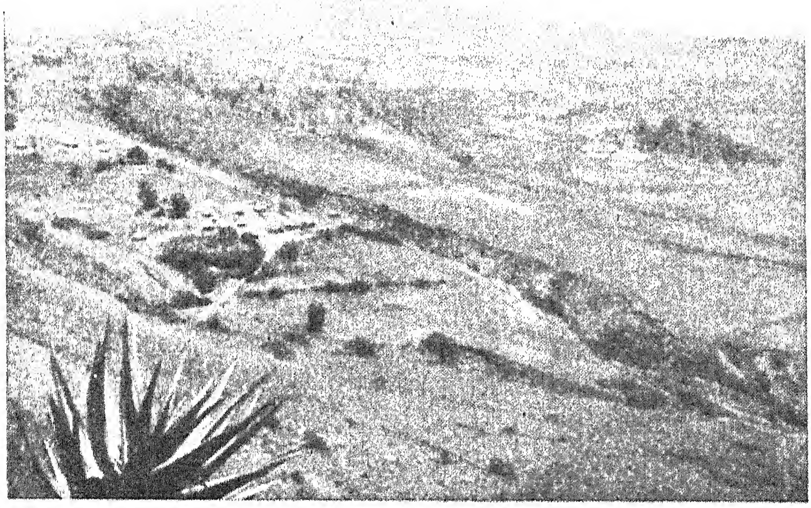
After the lands have been provided with contours, the soil will not be readily swept away. All that will then remain to be done, is to ensure that its fertility and structure are maintained by practising suitable systems of rotational cropping between the contours with due consideration of the manure and fertilizer requirements of the soil.

Soil Fertility in the Sour-veld Areas of Natal.

A. J. Taylor, Lecturer in Chemistry, College of Agriculture, Cedara, and J. D. Scott, Pasture Research Officer, Estcourt.

THE climatic conditions in the area east of the Drakensberg Range differ very materially from those prevailing in other parts of the Union. It is an area of relatively high rainfall and of more or less sour soils.

During the summer, the rainy season of the area, the moisture-laden air from over the Indian Ocean drifts inland, is forced to higher altitudes as it encounters the successive ranges of hills and mountains from the coast inland, and on the seaward side of such



Over-grazing on mountain slopes causes erosion.

elevations this moisture is precipitated as mist and rain. Thus are formed the "mist belts", areas of high rainfall, of clouds and mists and of reduced evaporation, areas of sour soils. All the soils to the east of the Drakensberg are not sour, for there are areas where they are sweet or only slightly acid, as in the "rain shadow" areas on the reverse slopes of the "mist belt" ridges, such as the deep valleys of the Tugela, the Mooi and other rivers and wider stretches in various parts of Natal and the adjacent districts.

Sour-veld Areas.

The particular areas falling within the scope of this article are (1) the coastal areas, largely under sugar cane; (2) the midland mist belts; and (3) the highveld high-rainfall areas.

Such climatic conditions exist not only at the present time but have existed during the long period of the formation of our soils.

The high rainfall, in conjunction with high summer temperatures, has dissolved out from the soil and its parent material soluble mineral salts which have been lost in the drainage water, carried away by streams and rivers and ultimately deposited in the sea. Thus the soils of such regions are deficient in lime and in mineral plant food generally. In consequence they are sour and of relatively low fertility compared with soils of the sweet veld, produced under drier conditions free from the leaching action of the percolating rain of the high-rainfall areas.

The Problem of Soil Fertility.

Whilst in the drier sweet veld the farmer's problem is that of water supply, in the sour veld it is more one of maintenance of soil fertility. There is a double drain on this fertility, viz., loss of plant food by cropping and export from the farm of crops and animal products, and loss of soil by erosion which, though not so serious as in sweet veld, proceeds apace once man has commenced to interfere with the order of Nature. This drain is all the more serious when the general lower fertility of sour-veld soils is considered.

Under natural conditions where the land carries a cover of forest or grass, the soils are moderately fertile, but once man interferes there is a progressive lowering of fertility. This depletion is particularly rapid when the land is brought under the plough, but also occurs, though less rapidly, under grazing conditions, particularly when overgrazed without adequate provision for the maintenance of the grass cover by resting periods for re-seeding and recuperation.

The maintenance and/or restoration of soil fertility could be considered under four main heads:

(1) System of Farming.

Nature's methods should be imitated as far as is practical. The complete adoption of Nature's system is limited by the fact that the farmer has to live and must farm to produce an income from the land, whereas Nature's concern is to build up the soil and maintain its productivity whilst providing food and shelter for the relatively scanty wild-life population—a well-balanced system with no export of fertility and a minimum of erosion. Unfortunately, in the past we have far too often not farmed our lands but have mined them; we have drawn on the soil capital without restoring to the soil any of the fertility removed, and have left the soils exposed to the erosion of wind and rain.

Constant maize or potato growing in the highveld, with little or no rotation, has done immense harm to our soils. The one crop with the same demands on the soil year after year, the constant intertillage of a row-grown crop often planted without regard to hills or contours, have all combined to deplete mineral plant food, to destroy the humus present in the original virgin soil and to facilitate erosion. A drastic change in this system is called for. A departure from the selling of crops to the sale of animal products derived from these crops is urgently needed. The feeding of crops on the farm means the restoring to the soils by the animal of most of the plant food taken up by the crop. There is far less export of soil fertility from the farm under such a system as the livestock products sold contain much less nitrogen, phosphate, potash and other mineral elements than do the crops used for feeding these animals.

It is essential to have a well-balanced system of rotation, adapted to the needs and possibilities of the farm and the climatic and soil conditions of the district. A legume must be included in this rotation and, in order that the legume may fulfil its function of making use of the nitrogen of the air, its roots must be well supplied with nodules, otherwise the soil or seed should be inoculated with the correct strain of bacteria. In the sour veld the soybean has been found to be a most suitable legume for including in the rotation, but unless grown on lands which have previously carried a well inoculated crop of soybeans, provision must be made for treating the seed with the necessary bacterial culture before planting. Information regarding the use of such cultures can be obtained from the colleges of agriculture where work on their preparation has been done.

The rotation should also include a crop giving complete soil cover and freedom from all cultivation and disturbance of the soil once it has been seeded. Suitable annual crops include oats, grass, such as Italian rye grass in the cooler areas, and legumes, such as sunn hemp, in the warmer areas. This period under complete cover may be extended to include permanent pastures, laid down for a number of years, avoiding all soil disturbance and loss of humus whilst the land is under grass. Such pastures fit well into a system of farming with well-planned rotations and a balance of crops and livestock. The better the pastures, the more stock they can carry and the greater is the amount of dung and urine returned to them, all of which helps to build up the fertility of the soil. Such a system is adapted to the sour veld with its higher rainfall, especially in the "mist belts", and with its lower evaporation favouring the growth of pastures. A grass well suited to this purpose in the sour veld is *Paspalum dilatatum*, a summer grass which, when properly managed and manured, provides good grazing for the dairy herd for six to seven months of the year. Such a pasture calls for good treatment if good grazing is to be produced; it must be well fertilized with phosphate and nitrogen if it is to last and remain productive for several years, although the inclusion in the pasture of clover, e.g., subterranean, in the high-veld will reduce the need for nitrogenous fertilizers. After a few years the productivity of such a pasture diminishes, its length of life depending on the original soil conditions and subsequent treatment. When the time comes to plough over the pasture and to end that phase of the rotation it will be found that a marked improvement in the soil has taken place. The mat of roots and stubble produced during the years of growth has added largely to the humus in the soil and improved its physical condition, whilst the accumulated fertilizer residues become available under cultivation. Annual crops may be taken off—still following a systematic rotation—for a few years, so "cashing in" on the accumulated fertility before the land goes under pasture again.

(2) Soil Organic Matter.

The value of humus cannot be stressed too often, although its effects on the soil are in general well-known to farmers. The application of that knowledge, however, is often deficient. Humus makes, in short, the difference between fertile top soil and raw infertile subsoil, the difference between newly broken-up veld or forest soil and the same soil after a few years of cropping with constant inter-row cultivation, a deterioration that goes on all too rapidly under the conditions of moisture and warmth of the sour veld. Apart from the

plant food present therein, humus serves various important purposes in the soil, improving the physical condition and so aiding in the retention of moisture and the penetration of roots, rendering more available plant food in the soil and providing suitable conditions for growth of the bacteria and other minute forms of life present in a fertile soil.

The maintenance or the improvement of the humus position is linked up with the farming system. Proper rotation of crops including pastures, the care of crop residues, the ploughing in of stubble before it gets so hard and fibrous that its decomposition is slow, the feeding of crops on the land instead of cutting and carting them to the byres which involves the further handling and carting of the manure back to the lands, all combine to maintain the humus content and fertility of the soil.

In the colder, more exposed regions of the high veld, it is not always possible to feed on the land, and under such conditions the production of the maximum amount of compost in central yards is well worth while.

Organic matter may also be added directly to the soil in the form of kraal manure, farmyard manure and compost. Every farmer realizes what a good dressing of kraal manure can produce, no matter what the crop, and this is especially true under conditions of good rainfall.

Besides acting as a source of organic matter, such manure also contains much of the mineral plant food and nitrogen originally present in the food consumed by the stock, its value in that direction depending very much on the nature and feeding of the animals. In kraal manure and farmyard compost there are also certain animal secretions voided in the dung and urine which have a definite, although not fully understood, effect on plant growth.

The results obtained from the addition of kraal manure or compost is very much greater in the sour veld than under the drier conditions of the sweet veld. This is a point generally not fully understood by those working in the drier regions.

Where kraal manure or compost are not available in sufficient quantities, green manuring is an alternative. Under high rainfall and suitable temperature conditions this method of soil improvement is more satisfactory than in drier areas as the better moisture conditions combined with adequate temperatures cause the green-manure crop to rot down more rapidly when it is ploughed into the soil. The best crops to use for this purpose are legumes, such as sunn hemp, lupins and soybeans, each suited to its particular locality, but to plough in most legume crops means the sacrifice of a valuable feed of high protein content. Normally it is more profitable to feed off the crop or use it for hay, only the roots, stubble and fallen leaves being ploughed in instead of the whole crop. If cut for hay instead of being fed off on the land, there is more loss before the manure can be returned to the soil. From the soil point of view feeding of the crop means a lesser addition of ultimate humus to the soil, but it also means a more efficient utilization of the crop. When the hay is fed in winter the dung from the stock can be used for compost and returned to the land. In the sugar-cane areas of the Natal coast there are at present many thousands of acres being put down every year to sunn hemp to be ploughed in as green manure.

Apart from leguminous green-manure crops there are others which can be used, e.g., oats, rye, Italian rye grass, crops primarily used for winter grazing in the cooler areas. An alternative to grazing

the new growth in spring is to plough it in as a green-manure crop. The ploughing up of a permanent pasture, of which the productivity has diminished, is a similar form of green manuring, whilst the sod condition of such soil is a guarantee against erosion. When a permanent pasture is ploughed in it has been found that the best crop to follow in the rotation is a legume which is not dependent on the soil for its nitrogen and so does not run the risk of nitrogen starvation whilst the ploughed-in grass or crop is breaking down in the soil. This is particularly the case in the high-lying colder areas.

(3) Fertilizer Requirements.

Despite the importance of humus in the maintenance of soil fertility it must not be permitted to obscure the necessity for providing the mineral plant foods required by crops. South African soils are almost universally deficient in phosphate, and this deficiency is especially marked in the sour veld where low availability of such phosphate as is present, accentuates the difficulty. In any fertilizer programme some form of phosphate must be included, a difficult matter in these days when the amount of phosphatic fertilizer available for distribution is only a fraction of our normal requirements.

Sour soils, especially the heavier doleritic type, rich in iron and alumina, tend to " fix " water-soluble superphosphate. For such soils it is better to use less soluble phosphates, basic superphosphate or the cheaper imported ground rock phosphate being suitable. These are slower in action and less likely to be " fixed " before the growing crop can utilize them.

Nitrogenous fertilizers are scarce, particularly sulphate of ammonia, formerly the cheapest and most commonly used form of nitrogen, whilst abattoir by-products are almost entirely used for stock feeding. This problem can, however, be met to some extent by growing legumes, inoculated before planting when that is required, so drawing on the inexhaustible supplies of nitrogen in the air. The legume can be included in the rotation or grown in conjunction with other crops as is done by sowing clover in pastures or cowpeas with maize. At Cedara, maize is now planted in rows 7 ft. 6 in. apart, leaving the plants somewhat closer in the rows than usual. This permits of cultivation being carried out more readily and efficiently and leads to better weed control. When the maize is well established, two rows of soybeans are planted between the rows of maize, so drawing on the nitrogen of the air and improving the soil for the next crop in the rotation, whilst the maize itself may derive some advantage from this association with a legume if the latter is established early enough. The soybeans may be cut for hay and thus provide a valuable protein-rich feed or may be harvested when mature. This double row of soybeans, when well grown, affords good cover to the soil, protecting it from the battering of heavy rain and helping to control erosion.

The sour veld differs from the drier areas in regard to potash which, as experiments have indicated, is apt to be deficient, particularly in lighter soils and even in heavier soils that have been under crop for some years. Potash should, therefore, always be included in mixtures used for crops, such as potatoes and roots, which make heavy demands on the potash of the soil as well as for other crops on old lands where potash has not been used in the past. At the present time the position in regard to the supply of potash fertilizers is not so serious as in the case of phosphate supplies. Another factor that helps to minimise the drain on potash in the soil is the fact that in mixed farming, where mainly animal products are sold from

the farm, the amount of potash exported is small. Local materials that can be drawn upon to provide potash are wood ash and Karroo manure. Despite the alkalinity of both of these manures there is very little risk in using these in the sour veld as, when applied in moderate amounts, any alkalinity is neutralized by the soil acidity and any harmful soluble salts are readily washed out by the rain.

In this connection the manurial value of purchased food-stuffs, used considerably by the dairy farmer of the more intensive areas of the sour veld, must not be forgotten. Such foods imported on to the farm mean the addition of some soil fertility, of some phosphate and other mineral plant food in addition to organic matter and nitrogen.

(4) Liming.

Liming is not a practice much in favour amongst farmers, even on our sour soils. This neglect of lime may be largely ascribed to the fact that maize, our staple crop, makes small demands on lime and is tolerant of acid conditions. Yet such soils are very lacking in lime, and for many crops—including legumes—the addition of lime is advantageous. Lime does not replace fertilizer and rapid results cannot be obtained from its use. It is of value in improving the general condition of soils, improving the structure and tilth of heavy soils, in making more available mineral plant food already present in the soil and in providing conditions favourable to the activity of beneficial soil organisms. Under present conditions of fertilizer shortage more attention should be given to liming soils. The farming of the sour veld is tending more and more to diversified systems and is abandoning the single-crop idea of maize growing, and just as the farming becomes more varied and intensified so does the call for liming become more insistent. Agricultural lime is a South African product, easily quarried and ground for use, and there is no shortage on account of lack of shipping to bring it to us from other countries which is the chief reason for our present shortage of phosphate.

Better Tillage.

The present shortage of fertilizer supplies has hit the sour veld farmer harder than his colleagues of the drier areas, for not only is the soil poorer, but the farming is normally of a more intensive nature. It is not easy to meet the difficulties caused by this lack of fertilizer, but the adoption of sound farming methods and the utilization of every possible means of supplementing the small amounts of fertilizer available for distribution, will all help to maintain production in these days when every effort is needed to produce the food required by the nation.

Many years ago Jethro Tull stated that "Tillage is Manure"—a maxim that should receive careful attention in these days of fertilizer scarcity. When land is being ploughed and prepared for the crop, let the work be done well. Good cultivation improves the physical condition of the soil, allowing of good water and root penetration, improving the availability of plant food in the soil and playing its part in crop production. Like many another good thing, however, cultivation can be carried to excess, causing loss of humus and encouraging erosion, but combined with proper rotation of crops (including pastures) and good management, it is an important means of combating present difficulties.

Maintaining Soil Fertility under Irrigation.

F. H. Bosman, Senior Research Officer, Grootfontein College of Agriculture, Middelburg, Cape.

SOIL fertility is one of the prime factors determining the success of any system of farming under irrigation. It is of considerable importance, not only because high fertility must be maintained to produce maximum returns from land which is highly capitalised, but also because under irrigation soil depletion can occur readily with faulty methods of production.

The most common causes of low fertility are (1) over-irrigation, (2) continuous production of crops which do not help to maintain the soil in sound condition, (3) insufficient use of kraal manure or other organic materials, and (4) insufficient or wrong applications of inorganic (mineral) fertilizers.

A close relationship exists between the amount of water applied to the soil and soil fertility, the yield and the quality of the product harvested.

While water is essential for the physiological activities of the plant it is not a food, but a medium for conducting foods into the plant.

Soil Moisture.

If the soil contains little available plant food, the solution in the soil is relatively weak and thus more water must pass through the plant to provide the essential substances required per unit of crop than would have been the case if the soil had been well supplied with plant food. Also if the soil becomes depleted of plant food during the life of the crop the rate of growth is retarded, but the rate of transpiration by the plant (i.e., the rate of loss of water from the soil through the plant) remains the same. From this it is obvious that the water required to produce a bag of grain, a bale of hay or a unit of any other crop is high when soil fertility is low. In fact, on poor soils the water requirement may be as much as half or even two-thirds higher than on fertile soils.

We see thus that low fertility results in uneconomical use of water, and it must be clearly understood that growth cannot be maintained under such conditions by simply increasing the irrigations.

The amount of water which a soil will hold is determined by the type of soil and its condition, but in all cases it is fairly limited. A loam soil may hold about twenty-five per cent. of water by weight after the excess or gravitational water, as it is known, had drained away, but all of this is not available to the plant, for wilting will occur when the water content has been reduced to about ten per cent. Heavy soils will hold more water than light soils, but the moisture content at which wilting takes place in the former is also considerably higher than in the latter. In normal soils the moisture content above the wilting point promotes plant growth. Production is, however, greatly influenced by the depth of penetration of water. Relatively deep-rooted crops, for example maize and wheat, are able to make use of heavier irrigation than less strongly rooted crops such as beans, peas and grasses. Crops must therefore be selectively irrigated, otherwise precious water and valuable plant foods will be lost by leaching.

It is necessary to consider irrigation as having two dimensions; the first is related to the amount of water applied per unit area per irrigation, the second to the frequency of irrigation.

The optimum quantity of water to apply per irrigation should penetrate the soil to the depth of the root zone of the crop, the frequency of irrigation needed will vary with the stage and development of the crop and climatic conditions.

Irrigation is an art which consists of applying water to the soil in quantities which preclude excessive leaching from the root zone.

Soil moisture has been dealt with at some length because irrigation practices have such an important and direct bearing on soil fertility and crop production.

Disadvantages of Over-irrigation.

Lucerne which has been established for a number of years on deep well-drained soil can make use of up to 8 inches irrigation, but younger crops should receive less. At the Grootfontein College of Agriculture, over a period of fifteen years, 30 inches of irrigation per season produced twice as much lucerne hay *per inch* as 96 inches.

On average soils summer and winter cereals should not receive more than about five inches per irrigation if good use of the water is to be made; potatoes, beans and peas should receive less, and grasses not more than three or four inches of water at a time. Irrigations in excess of these have been found to decrease yields.

At the College (with rainfall of 14-18 inches during the experiments) maximum wheat yields were obtained with 15 inches of irrigation per season, 30 inches gave 5 bags per morgen less. In spring the poor colour of winter cereals, often exhibited by crops grown under excessive irrigation, is usually due to lack of nitrogenous plant foods which have been removed by leaching. Heavy irrigations also delay maturity, favour the development of disease and frequently affect the quality of the crop adversely.

Over-irrigation is a very common and a very serious fault. As a rule irrigation beds are too long and too wide or the stream too weak to enable the correct amount of water to be applied. The reasons for this are the desire to economise labour when irrigating and to facilitate mechanical planting and harvesting. This practice is unsound whether or not water is a limiting factor.

Even though no loss of plant foods occurs through leaching, there are significant decreases of phosphorus and nitrogen amongst other fertility elements, caused by the removal of crops. It is claimed that even where crops are grazed only about half the nitrogen and two-thirds of the phosphorus is returned to the soil, unless a consid[erable] part of the feed consists of legumes.

Fertilizer Requirements.

Phosphorus must necessarily be returned in the form phosphatic fertilizer, but nitrogen can be increased in the soil by use of more leguminous crops and by the addition of manure compost, now that nitrogenous fertilizers are insufficient to requirements.

Potash is generally available in sufficient quantities in the to meet crop requirements. However, soil fertility is not determ merely by the quantity of available plant foods in the soil. If were the case it would be an easy matter, if perhaps an expensive to keep production at a high level, but fertility is the product number of conditions, some of which are not easy to develop maintain.

For the maintenance of fertility the soil must be in a good physical condition. To achieve this, the soil must be carefully handled; organic matter too, must be continually added.

When the organic-matter content of soil is increased, its fertility normally improves. Heavy soils become more friable, and light soils develop more body. In all cases bacterial activity is increased and more plant foods, particularly nitrogenous plant foods, become available. The soils are able to absorb and retain moisture more readily. Experiments indicate that it is impractical to maintain a high level of organic matter in the soil in hot climates, but it is necessary that a reasonable amount of plant material be turned in fairly regularly.

There are several ways in which the organic matter requirement can be met. Firstly, all manure should be conserved and returned to the soil, but it is unlikely that this product will ever be available in sufficient quantities to meet requirements. Secondly, surplus or waste plant products such as straw, stalks, husks, etc., should be utilized in the form of compost as far as economically possible. Thirdly, green crop residues or second growth may be ploughed under, or specific green-manuring may be practised. While favourable results can be expected from this practice on irrigated soils, the question whether green-manuring should be followed is mainly one of economics. Local conditions must determine whether it is more advantageous to harvest or graze or turn a crop under; whether the gain in yields following green-manuring more than covers the cost of producing the green manure and the loss of a season's production on a particular land. Fourthly, crop rotation will assist in maintaining soil fertility.

The residual organic matter in the soil as a result of decomposition of the roots of crop plants is not insignificant, but is often insufficient to meet the loss which is constantly occurring.

Grasses contribute considerably towards improving the physical condition of the soil, and for this reason their value should not be based entirely on their grazing or hay returns. Grasses must play a more important rôle in our agriculture than they do at present.

On already poor land it is advisable to start them with a fairly heavy application of manure or compost. For best results they should occupy the soil for not less than two years.

The ability of legumes to increase the nitrogen content of soils by means of nitrifying bacteria in their nodules is well known and for this reason they are of particular importance during the present scarcity of nitrogenous fertilizers. Where conditions permit, lucerne usually occupies an important place in irrigation farming, but better use of this crop can be made by using it in a short-term rotation. The use of lucerne as a grazing crop is increasing, and in this case a relatively short rotation can be applied to advantage because grazing decreases and shortens the life of the stand. For this reason it is more economical to establish new lands. A rotation system also benefits soil sanitation.

Our agriculture is comparatively young and already the soil resources do not allow for any losses of fertility.

Contours Prevent Erosion.

Mr. Gilson's farm, Herman, is situated in the so-called mist belt, and the lands are very sloping. Although Mr. Gilson always applied fertilizer very liberally because he was concerned about the fertility of his soil, he noticed about three years ago that some of his lands were beginning to show signs of erosion. He immediately started contouring his lands and the first year the difference between contoured and uncontoured soils was revealed.

One day, while he was busy on his lands he was caught in a heavy thunderstorm. He happened to be on a contoured part of his land, and on the opposite side there was a piece of uncontoured land. Both lands had been ploughed and planted shortly before, i.e., both had received the same cultural treatment. What did he observe? In the case of the contoured land the great volume of surplus water was slowly but surely conducted from the land on to the lower-lying veld under natural grass without the slightest damage being caused by erosion. On the uncontoured land the very reverse happened. The surplus water rushed right across the land in raging torrents, carrying with it a great mass of fertile soil and leaving unsightly dongas. That, however, did not complete the picture because the contoured land produced an excellent crop that year, whereas the crop on the uncontoured land did not even come up to expectation.

Mr. Gilson made further observations on contoured lands. The years 1941 and 1942 were very dry, but the lands which had been contoured retained their moisture for a far longer period. In fact, so greatly was the water-retaining capacity of the soil improved that it was possible to plough the contoured lands almost at any time of the year during that period and to obtain a crop, whereas this was impossible in the case of the uncontoured lands.

The implications of these observations are of course self-evident. Today all lands on Mr. Gilson's farm are contoured and about 600 morgen now lie under contour furrows from one boundary to the other. As much as 12 per cent. of the arable soil is taken up by contour furrows but the greatly increased water conserving capacity of the remaining soil and the better yields now obtained more than compensate for this loss.

(Submitted by J. J. Cilliers, Extension Officer, Kokstad.)

Fertilizers for the Maintenance of Soil Fertility.

Dr. M. J. v. d. Spuy and Mr. L. L. Eksteen, College of Agriculture, Glen, O.F.S.

HISTORY has proved that if man neglects to feed the soil, i.e., to restore to it whatever has been removed or, in other words, to maintain it in its original condition or even to improve it, his very existence may ultimately be threatened. The application of animal manure is as old as agriculture itself, and as far back as the year 45 A.D., Columella's observations led him to assert that the soil never

Effect of Fertilizer:—Left: no fertilizer. Right: 200 lb. superphosphate per morgen.
Yield per morgen:—Left: 8 bags. Right: 17·5 bags.

becomes exhausted if manure is applied. That the value of legumes for maintaining soil fertility has also been realized for more than ,900 years is evidenced by the fact that the ancient Roman farmers used to plough in a legume like lupins to enrich the soil. The use of wood ash is an exceptionally old practice and in their primitive farming the Red Indians fertilized maize with fish ash. In 1656 Glauber found that plant growth is stimulated by the application of nitrates, and subsequently Home obtained the same results with saltpetre. In 1835 sodium nitrate and in 1841 bird guano were imported into England from South America for experimental purposes. During this period Liebig advanced his Law of the Minimum in Germany, which postulates that the maximum crop yield is determined by the limi ng factor. In England Lawes started experiments in 1839 to test the possibility of using ground bones as fertilizer.

This work led to the treatment of bones and crude rock phosphate with sulphuric acid, and the patenting in 1842 of the process of manufacturing superphosphate. The production of artificial fertilizer was started the following year when Lawes, assisted by Gilbert, established the famous Rothamsted Experimental Station in England. Even to-day the problem of supplementing plant nutrients on an economic scale is still receiving real attention from research-workers. The result of all the above experimental work is increased production, so that Malthus' theory that mankind is heading for a food shortage owing to the increase in population being greater than the increase in food production has been exploded once and for all.

Soil Fertility and Artificial Fertilizers.

Artificial fertilizers are simple combinations containing plant nutrients and, if used judiciously, cannot have any other effect than to assist in building up the plant and, consequently, in increasing the yield. Surely if it is worth while cultivating a crop, it is also worth while promoting its growth by use of fertilizers.

Soil fertility may briefly be described as the crop-producing power of the soil. For a soil to be fertile, it should be provided with humus, be in good physical condition and contain sufficient soluble or readily available plant nutrients. Hence, apart from realizing the importance of controlling soil erosion and of practising rotational cropping in a system of mixed farming, farmers should also give careful consideration to the problem of fertilizing for maintaining the fertility of the soil.

Considering the large quantities of nutrients removed from the soil by crops, it is surprising to see how much some soils are still capable of producing after years of overcropping. The amount of phosphorus removed from the soil in the form of superphosphate by an apple or peach crop is from 50 to 90 lb. per morgen, and 125 lb. per morgen in the case of maize. Unless soil fertility is supplemented by the use of fertilizers, it must therefore inevitably become exhausted. The soluble plant nutrients which constitute only a small percentage of the total contents of the soil, are, however, not only affected by the production of agricultural crops, but also vary according to the area and type of soil.

A light sandy soil is usually poor, while a loam soil and heavier soils such as are usually found at the foot of hills or in valleys are more fertile Apart from the humus content and physical condition, there are, however, also other factors such as brak and soil acidity which may limit the productivity of the soil. Soil acidity plays a very important rôle is the assimilability of certain nutrients, especially phosphates which, under certain conditions, is present in the soil in an insoluble form. Certain crops are more sensitive to excessive acid than others, and although an acid soil may be fertile in other respects, a crop which is sensitive to acid cannot be expected to be successfully cultivated on a soil with a high degree of acidity. The object of using fertilizers and/or soil improving substances is to supplement the assimilable nutrients in the soil and to bring the soil into a condition favourable for maximum economic production.

Thorough and timely cultivation of the soil is, of course, just as important for the productive capacity of the soil as is the application of fertilizers. Experience has proved that the optimum in effect of fertilizers and reserve food elements in the soil is not obtained until the soil is brought into good condition as a result of effective cultivation. Of equal importance is the timely control of weeds, particularly during the growing period of the planted crop. It should

be realized that the weeds will compete with the crops, and unless controlled in time, will not only deprive the crops of moisture, but will certainly also consume a large percentage of the already limited quantity of assimilable plant nutrients.

Most Important Fertilizers.

Although a large number of elements are necessary for plant life, our agricultural soils are usually deficient in one or more of the following elements only: potash, nitrogen, phosphate and lime.

Effect of weeds on maize.

Potash.—Fortunately most of our soils, particularly those in the summer rainfall areas, have a high potash content. Nevertheless, there are certain crops such as fruit, grapes, tobacco, potatoes, sugar-cane, etc., which make heavy demands on the potash reserves in the soil and which would, therefore, benefit from an application of potash, particularly on light sandy soils. The deficiency may, where necessary, be supplemented by one of the following: kraal manure, karroo manure, potassium chloride, potassium, sulphate, etc.

Nitrogen.—This plant nutrient promotes new growth in practically all types of vegetation, and is absorbed mainly during the young stage when the plant makes active growth. If the plant has sufficient nitrogen at its disposal, it grows luxuriantly and the leaves have a healthy, green colour. If, on the other hand, there is a deficiency of nitrogenous food, the plant makes poorer growth and this is also evidenced externally by the light-yellow colour of the leaves. It should be noted, however, that an excess of nitrogen will not only cause the plant to grow too luxuriantly and render it more susceptible to fungous disease and attacks by insect pests, but the seed yield is likely to be seriously reduced, its quality lowered and maturity considerably delayed. This effect of nitrogen is particularly important in the lower and marginal rainfall areas. The more luxuriant the growth, the larger is the leaf surface and consequently, the greater is the quantity of soil moisture required to meet the requirements of the plant. In such areas the application of excessive amounts of nitrogenous fertilizer may, therefore, have a very adverse effect on rops.

Since the humus content of our soils is usually exceptionally low, it follows that the supply of nitrogen will also be deficient. Experiments have revealed, however, that soils in the summer rainfall areas are not really deficient in assimilable nitrogen, whereas in the winter rainfall area the application of a nitrogenous fertilizer is usually necessary. The difference is probably due to the more active nitrification in the summer rainfall area. When necessary, the nitrogen deficiency can to a large extent be supplemented by adopting systems of rotational cropping in which lucerne or some other legume is included, or by practising green manuring.

In the summer rainfall area the nitrogen deficiency is adequately supplemented by rotating maize with cowpeas, which can be grown for hay-making purposes, while in the winter rainfall area wheat can be very successfully rotated with lucerne where the rainfall permits of this being done.

Kraal manure and compost are also valuable for this purpose, but even though all these expedients are resorted to, the application of a fertilizer such as ammonium sulphate, sodium nitrate, etc., will still sometimes be necessary.

Phosphate.—This is an important plant nutrient in which most of our soils are particularly deficient. Kraal manure, compost and Karroo manure may be used to a certain extent to supplement the deficiency, but unfortunately the phosphate content of these manures is so low in relation to the nitrogen content, that the application thereof to supply an adequate quantity of phosphate inevitably results in an excess of nitrogen being introduced into the soil as well. Used in conjunction with phosphatic fertilizer, however, these substances are very effective, especially in soil under irrigation and in the case of crops such as fruit, potatoes, vegetables, tobacco, etc.

The most important phosphatic fertilizers are bonemeal, rock phosphate and superphosphate. Owing to the existing shortage of bonemeal, its use as a fertilizer is for the present out of the question, but in normal times it can be successfully used for garden flowers as well as in fertilizer mixtures for agricultural crops.

Rock phosphate consisting of water-insoluble calcium phosphate may in many cases be successfully applied. In the summer rainfall area a mixture of rock phosphate and superphosphate is very effective, and in acid soil rock phosphate usually yields even better results.

When permanent crops, such as fruit trees and lucerne are planted, this insoluble phosphate is very suitable for raising the phosphate reserve in the soil, and for this purpose should be worked in to a good depth when the soil is being prepared. Legumes and buckwheat possess the property of making very good use of the less soluble phosphates; consequently, rock should yield good results where these crops are planted in rotation with others. The use in such cases of rock phosphate, which contains 33 per cent. phosphorus pentoxide and which usually costs just as much as high-grade superphosphate, will, of course, also build up the phosphatic reserve of the soil.

Superphosfate is the best known and, therefore, the most frequently used phosphatic fertilizer. In experimental work it has so far received most attention. Except in the case of excessively acid soils, superphosphate can always be successfully used to make up t[illegible] ect phosphate deficiency. The quantity to be applied depends m[illegible] d on the locality and the kind of crop which is grown. Potat[illegible] ffective garden crops should be given half a ton per morgen, maize [illegible] weeds. per morgen and wheat up to 350 lb. per morgen. In certai[illegible] It should where the soil is deficient in phosphate, it has been found that

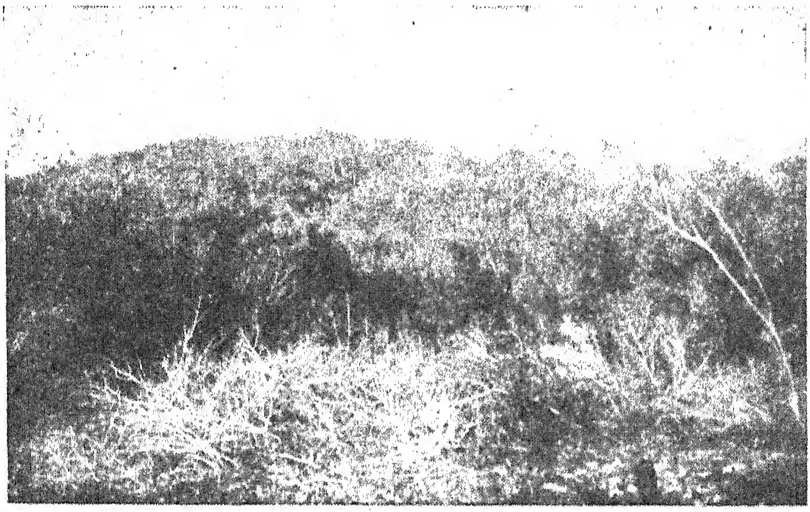
 [*Continued on*

Effect of Tree-Planting on Soil Fertility.

J. J. Voorendyk, Division of Forestry, Pretoria.

THE planting of trees in the form of plantations or windbreaks and to a lesser extent, isolated trees, has a beneficial influence on soil fertility. This influence is briefly discussed below:—

(1) *Trees enrich the soil with large quantities of humus.*—The plant litter (leaves, bark, twigs, flowers and fruit), which continually falls from trees, gradually turns into humus and in this way greatly improves the fertility of the soil.



Trees which bind Driftsands and provide Firewood.

Most kinds of trees produce more litter per surface unit over a number of years than smaller plants, and since the process of decomposition is more active under trees than in the open, trees are much more useful in building up the humus content of the soil in a natural way over a shorter period.

(2) *The extensive root system of trees is an important factor in the improvement of the physical condition of the soil.*—The extensive root system of trees which penetrates deep and far into the soil, helps to break up and crumble the soil and to improve its structure. If a tree is felled and the stump does not sprout, or is left in the ground, the root system will decay and leave a vast network of large and small connecting-passages in the soil.

This network of passages is an important factor in the aeration of soil and the effective percolation of water, and will result in rocks and minerals being exposed at greater depths to the action of chemical disintegration which breaks up the soil still further.

(3) *Trees allow of better and more gradual penetration of rain-water into the soil.*—In a land of heavy downpours, like South Africa, trees are of great value since they act as a buffer to break the fall of the rain by allowing the water to run down the leaves, twigs and trunks more gradually, with the result that the soil can absorb the

largest possible amount of water. The accumulated litter under the trees further increases the value of trees in this respect.

All plants, for that matter, have this effect, but since trees, especially in mass formation, give much greater cover to the soil, their beneficial effect will be more far-reaching, and a larger volume of water can be checked. In addition, if trees are planted scientifically, in strips along the contour, they can serve as permanent contour-embankments to spread the water over the veld, and so prevent the formation of dongas as a result of erosion. For this purpose trees will naturally have to be chosen which keep their branches permanently near to the ground.

(4) *Trees protect the soil against harmful hot winds and the scorching sun.*—A great volume of rainwater is lost in South Africa because the soil cannot absorb it during a rain. This water is either swept to the sea along furrows, roads, sluits and rivers or lost through evaporation.

Where trees stand in mass formation, the soil is usually protected from the direct rays of the sun throughout the day, and air-currents are modified to such an extent that evaporation is reduced to a minimum, and the moisture retained in the soil.

The rôle played by trees is, however, far greater where they can reduce evaporation on soil not covered by trees. Mention need merely be made in this connection of the protective influence of wind-breaks on lands and the bare grassy plains of our country.

The moisture in the topsoil is evaporated by the sun and wind and the moisture in the subsoil then continually moves upwards by capillary acton, also to be evaporated in due course.

A well-planted wind break can protect soil on the lee side to a distance of twenty times the height of the trees, and even on the windward side, to a distance of three times the height of the trees.

A series of windbreaks, spaced at distances of 20 times the height which the trees will eventually reach, will therefore protect the soil from strong winds which accelerate evaporation, and so assist in the conservation of soil moisture.

(5) *The climate in and above the soil is modified by trees, and the development of earth worms, micro-organisms and chemical reaction necessary for soil fertility is promoted.*—Soil which is covered by trees never becomes quite as hot during the day or as cold at night, as soils without any vegetal cover or soils only sparsely covered with small plants. Since the moisture content of soil under trees is kept at a more constant level than that of bare veld, ideal conditions are created for the development of plant and animal life. A constant temperature and a constant moisture content of the soil also promote the chemical reactions which break up the different minerals into their numerous elements, with the result that the soil is continually built up.

(6) *Trees also prevent soil erosion and the formation of drift-sand and can be successfully used to control these evils.*—Owing to the extensive root system of trees the excellent cover provided by the leaves, etc., which fall from them constant moisture content of the soil, and the effective manner in which they shield the soil from strong winds, the chances of surface or donga erosion and wind erosion are much smaller in areas which are covered by trees than in unprotected areas.

(7) *The requirements of trees in respect of plant nutrients are much smaller than in the case of other agricultural crops.*—For the

volume of material built up and the value of the product, viz., wood, a tree uses much less plant food in proportion to its size than any of our common agricultural crops, since it consists mainly of carbon derived from the air. In addition, trees build up larger quantities of plant nutrients than they consume.

(8) *Trees provide the cheapest and most satisfactory fuel for farm use, and so obviate the necessity of using farm manure for this purpose.*—South Africa is pre-eminently a pastoral country and manure which is naturally spread over the veld by stock should be left on the soil to enhance its fertility, and not be taken away to be used as fuel.

Wattle-waste packed in long Rows on the Contour.

It is also wrong to dig out manure which has accumulated in stables or kraals and then to use it as fuel when dry because if farm grass, straw or any other plant remains are spread systematically in the stables or kraals, and collected again later ond and stacked in heaps, large quantities of valuable compost can be made. The only solution to the fuel problem on farms is to plant trees in small plantations or wide windbreaks. These trees will not only have the beneficial effects mentioned above, but they will also provide all the required firewood. There is no farm in South Africa which cannot produce its own firewood.

The advantages of trees hardly need further stressing but a point which should not be lost sight of is that the extent to which trees will influence the fertility of the soil will largely depend on the climate of the area concerned, the kind of tree planted, the treatment of the trees and the special local conditions or place of growth.

So, for example, it is obvious that the accumulated litter under trees in the warm, high-rainfall areas of eastern and northern Transvaal and Natal, or in the moderately good rainfall areas of the eastern and western Cape Province will be converted into humus more readily than on the highveld of the Transval, Orange Free

State and Northern Cape Province where the annual rainfall varies from 15-25 inches, and the summer is hot and dry and the winter cold and dry.

As regards the kind of tree to plant, deciduous species are generally preferable to evergreens because the annual amount of vegetable material which collects under the trees is so much greater. Conifers, again, are preferable to evergreens.

Where trees are planted in strips along the contour to act as windbreaks, or to spread rainwater over the veld, types which have dense crowns and which retain their branches near the ground, must be chosen. In any case the treatment of trees is of the utmost importance.

Trees must be well protected and managed from beginning to end in order to obtain the greatest possible direct and indirect benefit from them.

In the past, for example, it was customary to burn down the wattle plantations after the bark and the useful wood had been removed, with the result that all the litter consisting of branches, leaves and undesirable bark as well as the half decayed plant material and the greater part of the humus already formed simply disappeared in smoke. Consequently, the soil was exhausted instead of being enriched.

To-day all the litter is stacked in long rows along the contours and allowed to decompose into humus before the next bark-crop is collected. In this way the soil is greatly enriched.

Where to Plant Trees.

The beneficial effect of trees on the soil will to a large extent be determined by the place where they are planted. On level soil the chances that all the waste material will be burned into humus are much greater than on sloping soil, where it may be washed away before it can form a compact layer. In this case it is therefore of the greatest importance to choose the right type of tree.

In this article it is only possible to touch upon a few of the beneficial effects of trees on soil, but in conclusion a few concrete examples in support of what has been said, may not be out of place.

In state afforestation schemes it is necessary to plough and harrow soil once or twice when it is to be planted with trees for the first time, and to get it into good condition. An alternative procedure is to make well prepared holes. Soil which is planted with trees for the second time, needs no such preparation, since the soil is soft and loose. Where trees have stood on soil for 15 to 20 years, the latter has been improved and built up to such an extent by the litter, roots, earth worms, micro-organisms and constant moisture content that an ordinary spade is now sufficient for establishing young trees sucessfully.

In Natal it has been found that if a wattle plantation is well managed along sound silvicultural lines, and the waste stacked along the contour instead of being burned, the second rotation grows much better than the first. In Kenya the same wattle (*Acacia mollissina*) is used in a system of rotation to improve exhausted maize lands.

On his farm, Westfalia, in the northern Transvaal, Dr. Hans Merensky has demonstrated in no uncertain manner how *Eucalyptus saligna* can be used to improve old exhausted soils. Part of his soils

[Continued on page 678.

Compost for Vegetables.

J. C. le Roux, Professional Officer (Horticulture), Sub-tropical Horticultural Research Station, Nelspruit.

THE importance of kraal manure in the cultivation of vegetables is being increasingly realized by farmers. In view of the present scarcity of kraal manure and fertilizer, farmers are advised to make as much compost as possible and to apply this in the most economic manner. In so far as the quantities of compost and the method of applications are concerned the requirements of different kinds of plants should be taken into account. It is uneconomic to apply more fertilizer than the plant actually needs for its normal development. Nevertheless, the quantities should be sufficient for ensuring profitable production and the maintenance of soil fertility.

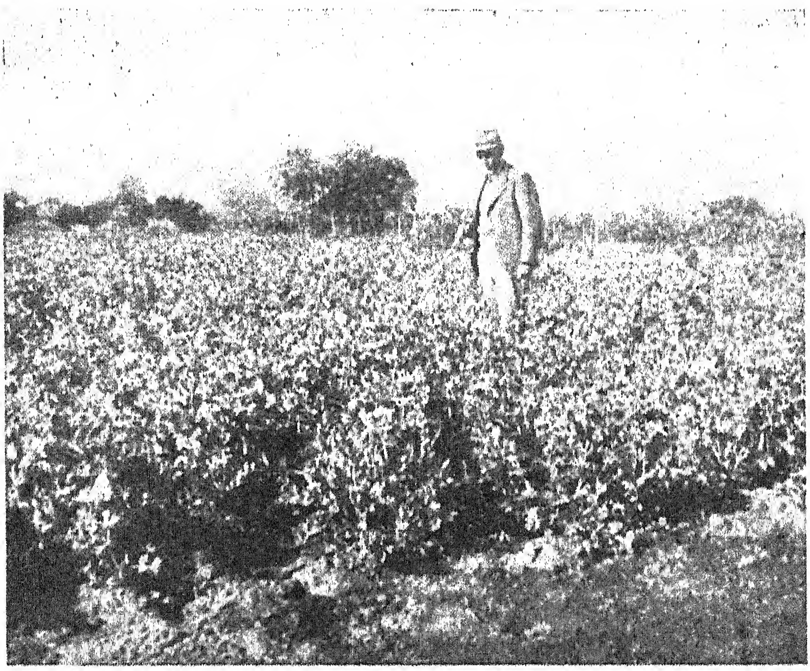


FIG.—Greenfeast peas on sandy soil treated with compost at the rate of 12 tons per morgen.

No definite method of fertilizer application can be recommended, since the kind and quantity required will depend on various factors, such as quantities and kinds of fertilizers available, natural soil fertility, use of legumes, residual effects of fertilizer applied to previous crops, and weed control.

The following applications, although inadequate for maximum production, are nevertheless recommended in view of the present fertilizer shortage.

Quantities of Fertilizer per Morgen:—

For *leaf crops*, such as cabbage, cauliflower, spinach and lettuce, 15 tons of compost and 600 lb. of fertilizer mixture D or E may

be applied per morgen. Both compost and fertilizer are mixed with the soil in the drills.

For *legumes*, like green beans and peas, 10 to 12 tons of compost and 400 lb. of fertilizer mixture C may be applied per morgen. The compost and fertilizer are well mixed with soil in the drills.

For *trailing plants*, like vegetable marrow, cucumbers and pumpkins, 7-10 tons of compost and 300 lb. of fertilizer mixture C are applied, the materials being thoroughly mixed in the soil in the planting holes.

For *tomatoes and egg-fruit* (brinjals) 10-15 tons of compost and 400 lb. of fertilizer mixture C are applied, the materials being mixed with the soil in and along the drills.

For *root and tuber crops* like carrots, beetroot, potatoes, onions and sweet potatoes, 15 tons of compost and 600 lb. of fertilizer mixture F are applied. Both compost and fertilizer are applied in the plant rows or beds, except in the case of sweet potatoes where the compost is broadcast on the land immediately before the final ploughing, and the fertilizer sown only in the plant rows.

The above quantities are about half the amounts which should normally be applied. Decline in soil fertility due to reduced applications of fertilizer can be partly remedied by following a proper system of crop rotation, weed control, the application of good methods of irrigation and by growing inter or cover crops.

Effect of Tree Planting on Soil Fertility:—

[*Continued from page 676.*

has been planted for years to maize and groundnuts and, when he took over, was in such an impoverished and eroded condition, that no annual crops could be grown on it with any reasonable hope of success. Citrus and tropical fruits were also a total failure on this soil. On a portion of this soil he planted *Eucalyptus saligna* for mine props, and after the plantation had been cut down three times for mine wood, Dr. Merensky decided to plant annual crops, citrus and tropical fruits again. In every case he has had outstanding success, because the trees have built up the soil to such an extent during the 20 years that it is now in a highly fertile condition.

In conclusion, we must not forget how the Port Jackson Willow (*acacia cyanophylla*) has stabilised thousands of morgen of dangerous and useless sand dunes along the coast of South Africa, and in many cases turned it into very valuable soil.

Humewood, Port Elizabeth, now one of our most beautiful seaside holiday resorts, was once a barren stretch of miles of undulating white sand dunes, and the Cape Flats were for years a menacing desert of sand at the very entrance to Cape Town. Here land which could not be disposed of at 10sh. a morgen 30 years ago now realizes unheard of prices.

Where trees become a nuisance, or have an adverse effect on other crops, it is not the trees which are to blame, but the farmer's fault if he makes bad use of a good article. There is a place for every type of tree, and in every case the correct choice is a matter of the utmost importance.

Fertility in Citrus Orchards.

A. C. Bathurst, Division of Horticulture.

IN the main citrus areas of the Union citrus is grown under a wide range of conditions. The best orchards are usually those where there has been little erosion, and where strict control has been kept over the irrigation water.

While orchards can be improved by manuring, irrigation or cultural practices, poor laying out of the orchards may cause irreparable harm through erosion on account of lack of contours or correct levelling. The experience of numerous farmers goes to show that once the topsoil has been lost, or the soil damaged by over-irrigation, it is often an impossible or uneconomical proposition to build it up again. In a number of orchards where individual tree-records have been kept, it has been very noticeable how the trees at the lower end of the orchard tend to out-yield those at the top, largely owing to the fact that much of the rich topsoil from the upper part of the orchard has been washed to the trees lower down.

Value of Topsoil.

Although the necessity for preserving our soil has often been stressed, yet it does not seem that sufficient emphasis has been laid on the difference in value between the surface soil and sub-soil. One reason for this difference is that plants absorb nutrients from the lower soil-layers and, on decomposition, enrich the upper soil-layers at the expense of the lower. The decomposed plant-material contains essential plant foods for new plant-growth; furthermore micro-organisms tend to flourish in the upper soil-layers where air is abundant, and certain of these micro-organisms have the power of obtaining their nitrogen directly from the air (a property of which plants are incapable) and are thus the original source of practically all the nitrogen found in our soils to-day.

It is thus plain that surface soil is really something quite unique. It has taken thousands of years to build up, and is a substance quite distinct from the lifeless subsoil which, while probably possessing a large reserve of food material, holds this in a form so slowly available to plant-life as to be relatively worthless.

Under natural conditions, where little or no erosion takes place, soils tend to increase in fertility over a long period of time. Under conditions of cultivation, however, much of the top-soil is bared and a heavy rainstorm or uncontrolled irrigation may wash away, in a few hours, as much of the valuable upper layers as it has taken a hundred years to build up. A farmer cannot hope to prosper on such eroded land.

The benefits to be expected from the preservation of the top-soil in the case of semi-permanent crops like citrus are certainly no less than where annual crops are concerned. The grower of annual crops can, at least, change his lands occasionally if necessary, but the citrus tree, once planted, must give a return for 20 years or more.

A Successful Dryland-orchard.

In this connection the true story of " Mr. Tom " may be of interest to citrus growers. Mr. Tom is not a text-book citrus grower, but a practical man.

Some 40 years ago he started his orchard on a few morgen of the poorest, coarsest, sandiest soil, planting perhaps 50 citrus trees one year and 100 the next. His farm boasts no river, no borehole,

only a small spring that supplies the houses and a small vegetable garden. In a very good year he gets 30 inches of rain, in a poor one less than 20 inches. Wise citriculturists and neighbouring cattle-farmers, therefore, shook their heads and prophesied failure. "You can't grow a citrus tree without irrigation," they said. But Mr. Tom kept on planting seedlings first, then naartjies, Navels and Valencias. To-day he has some 6,000 trees, and still keeps on planting. The fruit tastes good and the trees look healthy, and bear well though not as well, of course, as many trees on better soils under irrigation. But his business pays, and pays well.

What are the secrets of his success? Actually there are no secrets. He has just preserved the natural fertility of his soil. His trees are not laid out in mathematically perfect squares, triangles or hexagons, *but along contours*. Between the rows and along the contours, are a dozen or more plough-furrows a foot deep. These stay open the year round, and collect every drop of rain that falls on them. A few weeds grow there in summer, but these are ploughed back again when the furrows are remade in the autumn. If a tree is lucky it gets a couple of paraffin tins of manure once in three years or so. Yet the leaves are dark green and there is plainly no lack of nitrogen. A soil-tube put down to four feet showed a poor coarse sand—the sharp white kind one prefers for cement-making, but damp even in the middle of the dry season. The roots of the trees go deep down, and probably not a drop of water nor an ounce of plant food is carried below them, or they could not be in such a good condition.

This orchard is indeed the almost perfect example of how the natural fertility of a soil can be preserved. There has been no erosion of top-soil, no run-off of water. What rain falls is caught and used before it can reach below the root zone, and neither trees nor soil have been damaged by over-cultivation. Weed-growth is not allowed to interfere with the growth of the trees, yet a certain amount of weed-growth is favoured, since it helps to bind the soil, check erosion, and supply a small amount of humus each year.

Admittedly, one would not advise planting citrus without irrigation to-day, and the example given is an exceptional one; yet, if such a farm can be made to pay under dryland conditions, why cannot every farm under irrigation be made to do the same?

Fertilizers and the Orchard.

While surface erosion and over-irrigation or faulty irrigation methods are probably the root cause of many unthrifty citrus orchards, yet there are other factors of almost equal importance that must be considered—such as faulty manuring or fertilizing.

As pointed out, plants by decomposing in the upper soil-layers tend to deposit there those plant foods which are favourable for their growth. This naturally decomposed material, and also plant material purposely and rapidly decomposed by man and known as "compost", does therefore contain a more or less balanced ration of food materials for plant life. Since both decomposed plant material, compost, and ordinary manure, which is really a very similar product, hold these plant foods in an available form and yet not subject to rapid depletion by rain or irrigation, and since all have remarkable properties of improving soil tilth, and an extraordinary capacity for holding water, there is little wonder that the value of such materials has been realized from ancient times.

When, however, sensational claims are put forward that compost is a kind of magic touchstone without which no plant can develop

normally, and that the use of "artificials" is slowly but surely leading mankind to extinction, it is high time to contradict such pseudo-scientific statements. "Artificials", used in proper amounts and proportions, undoubtedly have their place in most intensive systems of agriculture to-day, and can be of extreme value in citrus orchards. It is not, however, the purpose of this article to go into details on the question of the fertilizing of citrus trees, but rather to point out that a system of judicious manuring and fertilizing, in addition to a system of conservation of top-soil and prevention of the leaching-out of valuable plant foods, is an essential in nearly every orchard if the fertility of the soil is to be maintained. Compost and manure are, undoubtedly, the most "foolproof" materials that we have, and their use can be recommended without hesitation. At the same time "artificials" may often supply the required plant-foods in a cheaper and more readily available form, though admittedly, they are not always used correctly. In this connection it should be stressed that the services of the Department of Agriculture and Forestry are always at the disposal of farmers for advice on such matters, or indeed, on any matters connected with citrus growing.

The citrus industry is of major importance in this country to-day and, unlike a gold-mine, which must one day work itself out, should remain of permanent benefit to the country.

Good citrus soils are definitely limited in extent, and, being among the most valuable soils in this country, it is of vital importance that their fertility should be maintained.

The Role of Fertilizers in the Maintenance of Soil Fertility:—

[*Continued from page* 672.

superphosphate per morgen will double the maize yield and increase the phosphate content of the grain by more than 50 per cent.

Constant and regular fertilizing with phosphate also gradually increases the phosphatic content of the soil. After a thorough application of phosphatic fertilizer the residual effect is still noticeable for several years afterwards. Consequently, farmers who made regular use of phosphate in the past will, in view of the present fertilizer shortage, now profit by having done so.

In spite of the fact that the manufacture of superphosphate was started a century ago and that the results of experiments, some of which were also carried out nearly 100 years ago, have shown conclusively that the application of superphosphate cannot but be beneficial to the soil, there are still many farmers who are sceptical about the use of this particular fertilizer. It is alleged *inter alia* that the continuous use of superphosphate renders the soil acid and hard. Others again maintain that if the soil has once been fertilized with superphosphate, it will never again produce good yields without further applications. There is no foundation for these beliefs, and although the continuous use of a fertilizer such as ammonium sulphate does admittedly turn the soil acid, this can easily be prevented by the application of lime.

Lime (*Calcium*).—Although lime is one of the indispensable or essential elements for plant life, the soil usually contains so much of this constituent that the plant does not lack any. Some soils, however, may need it and in such cases lime does not really act as a ferti-

[*Continued on page* 704.

Municipal Compost.

J. P. J. van Vuren, Regional Officer for the Municipal Compost Scheme.

ALTHOUGH the method of preparing compost of this type is not really applicable to rural conditions, the matter is nevertheless of great importance to farmers since they are generally the eventual users of the product. It is therefore hoped that the following few hints will not only help to make the product better known amongst farmers but that they will also remove any prejudice which may exist against its use.

Suitable Material.

For the effective preparation of compost an adequate supply of vegetable material is naturally essential. Whereas on the farm compost is made from straw, grass, leaves, etc., it can be prepared in cities and towns from large quantities of house and street refuse which contains *inter alia* the peels and skins of vegetables and fruit, flower stems, lawn cuttings, light tree-prunings, general garden rubbish, etc., to mention a few only.

A second important material very frequently used in compost making is animal manure. This constituent plays a double rôle in the process. In the first place animal manure contains readily assimilable nitrogen which is necessary for the sustenance and multiplication of the organisms responsible for the disintegration of vegetable material. Secondly, manure also contains those organisms themselves so that the mass of vegetable material is virtually inoculated with the organisms. Although it is also possible to prepare compost without the use of animal manure, it has been found that this ingredient considerably accelerates the process of disintegration. In the case of Municipal compost making where no animal manure is available for this purpose, use is made of human excreta which, in so far as the process itself is concerned, possess the same characteristics and play exactly the same rôle as animal manure. Calculated on the percentage of dry material contained in night soil, only one-twentieth of finally prepared Municipal compost actually consists of night soil, the remainder being made up of other materials which are used in the process for absorbent purposes. The idea therefore, that municipal compost consists mainly of night soil, which is probably the reason for the prejudice against its use, is therefore wholly unfounded.

A third important requirement for any compost is moisture or water. On farms clean water is usually used for the purpose. Sometimes urine from stables is used either mixed with washing water or pure. In the case of Municipal compost only human urine is used for moistening purposes and, consequently, this product can be expected to be richer in plant nutrients than farm compost, for example, since urine contains a considerable amount of nitrogen and potassium.

There are, in reality, no fundamental differences in the preparation of these two types of compost. In both cases the principle is the same, the only difference being in the original material used for composting.

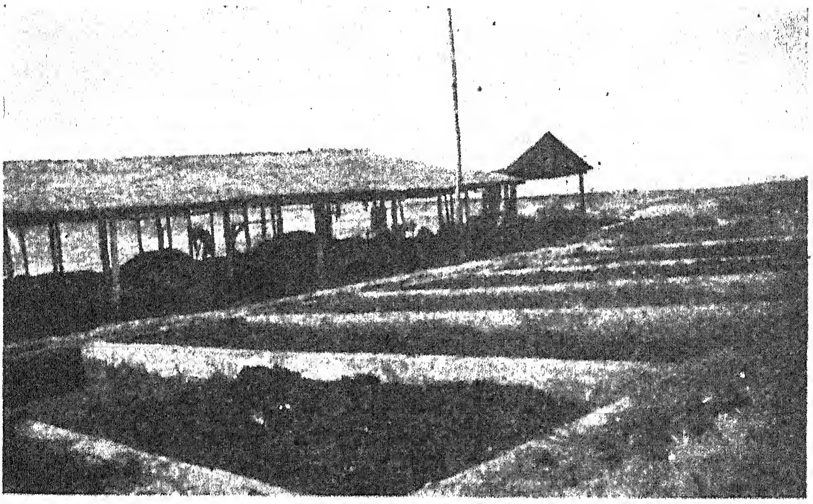
Prejudice against Use of Municipal Compost.

Although hardly any cases have hitherto occurred of farmers objecting to the use of a product containing human excreta, it is

nevertheless felt that some people have their doubts and for this reason the following explanation is given.

If the product still has a slight smell of night soil left, when it is bought, this must be regarded as an indication that the product is of inferior quality or at any rate, that the process has not effectively been carried out. Well-prepared municipal compost should not give off any objectionable smell whatever, and, moreover, should not contain any material which is still identifiable. Good Municipal compost, like good farm compost, has the smell of moist rotting leaves or moist freshly-ploughed fertile soil, i.e., a clean and pleasant odour.

As in the case of farm compost, fermentation during the making



Process of Compost-making from Municipal Refuse: Pits and Drying Shed.

of municipal matter is accompanied by high temperatures. Temperatures of 140° to 160° F. in the compost heaps, are by no means uncommon. Furthermore, it has been medically determined that practically all harmful disease germs present in human excreta are destroyed at temperatures between 120° and 130° F. In the process of preparing municipal compost the temperatures remain high for days on end so that there is very little likelihood of some injurious organisms remaining alive and subsequently spreading provided, of course, that the process is correctly carried out.

The destruction of disease germs which may possibly be present, however, is so closely connected with the success of the process itself that one would be justified in assuming that a final product which appears sound to the eye and nose will not contain any living dangerous disease germs. Unless the original material was subjected to high temperatures for a reasonably long period, the final product will not pulverize, assume a dark colour or give off a pleasant smell—the characteristic properties of good compost. If farmers refuse to accept any suspected consignment the manufacturer concerned will soon take steps to ensure that the process is effectively carried out.

All municipal compost schemes are under the control of municipal health inspectors so that the chances of an infected product being offered for sale are very slight. If the composting process is carried out in accordance with the instructions of the Department of

Agriculture and Forestry there is, according to the findings of the Department of Public Health, not the slightest danger that diseases will be contracted or spread by the use of the product for fertilizing purposes.

Municipal Compost as Fertilizer.

Just like farm compost, stable, kraal and karroo manure, municipal compost is an organic fertilizer, consequently, it cannot be regarded as an artificial fertilizer nor can it be used as a substitute for the latter. The greatest value of organic manures lies in their organic matter content. For this reason it is often doubtful whether slight applications can have any beneficial effect on soils and crops. Municipal compost contains no harmful salts and, consequently, can be used by any farmer, no matter where his farm is situated.

This alone is more than can be said of some of the other organic manures. In addition, heavy applications do not involve the risk of an ultimate harmful effect on the soil. Furthermore, municipal compost, like good farm compost contains no harmful and viable weed seeds since these have been destroyed by the heat, generated during the process.

A farmer is more justified in using this compost for crops like potatoes, tobacco, vegetables, green feeds, silage, etc., than for crops giving lower yields for crops for which there is a smaller demand or for cereals in general. It is doubtful whether it will pay him to use the product for growing maize or wheat unless it is applied together with phosphates in minimum quantities of 6 to 8 tons per morgen.

The price charged for municipal compost is somewhat high, differing from one locality to another and ranging from approximately 1s. to 3s. 6d. per bag. The reason why the product is sold by measure and not by weight is because the weight fluctuates according to the moisture content. In order to protect both the producer and user of compost, it has been suggested that municipalities should sell their compost by measure, i.e., at so much per cubic yard or bag.

Farmers who are interested in the use of compost, should ascertain from their nearest municipality whether it already manufactures the product. The Department of Agriculture and Forestry to-day gives all municipalites the necessary guidance and advice in connection with the conversion of their refuse products into compost. This is being done because of the present shortage of mineral fertilizers which must be imported from overseas and also with an eye to any future shortage which may arise as a result of the exhaustion of the country's sources of karroo and other manure. If the municipal composting process is carried out according to the advice and instructions of the Department, the latter has no hesitation in recommending the use of the product.

Farm Compost.

J. H. Preller, Professional Assistant (Division of Soil and Veld Conservation), Döhne Experiment Farm, C.P.

BY compost is meant the product obtained when waste material of vegetable or animal origin is subjected to a process of rotting or fermentation with a view to its partial or complete disintegration in order to get the greatest possible quantity of organic material incorporated into the soil.

Compost should be regarded as an essential product for maintaining our agricultural soils in a good, sound productive condition. Owing to its relatively low plant nutrient content, however, it should

Effect of application of 10 tons of compost per morgen (right) against 400 lb. superphosphate per morgen (left).

on no account be regarded as a substitute for fertilizers, especially phosphate. The application of compost in conjunction with the small quantity of available fertilizers will ensure much better crops than the application of fertilizer alone.

With the increasing scarcity of fertilizers, particularly phosphate, potash and ammonium sulphate, due to war conditions and the resultant heavier strain on the Union's agricultural soils which are used for the production of food for human and animal consumption, increasing attention is being paid to the use of compost as the principal means of maintaining the soil in a healthy and productive condition. It is because the Chinese realized the importance of compost that they have been able to cultivate the same soil for thousands of years without exhausting its fertility. The Chinese farmer does not allow a scrap of organic material to be lost—everything is returned to the soil.

If our farmers had also appreciated the value of compost and realized that fertilizers alone are not sufficient, the fertility of our

agricultural soils would not have deteriorated to such an extent during the past 20 years or so, and soil erosion would not have increased at such an alarming rate.

One cannot but admit that the present fertilizer shortage is a blessing in disguise to our farmers, since they are now in a position to convince themselves of the value of compost and the necessity for introducing organic material in the form of kraal manure or compost into the soil. Once they are convinced, they will never change their minds.

Material Suitable for Compost.

All waste material of vegetable or animal origin must be collected and converted into compost. This includes such material as the waste from hay stacks, surplus old veld grass which has been cut during the winter, instead of being burnt, maize stalks, wheat straw, all weeds from gardens and cultivated lands, mouldy silage, prunings from hedges and trees, kitchen refuse, night soil, stable manure and urine, fowl-droppings, etc., etc.

All too frequently such material is still piled into heaps and burnt or buried, because it is regarded as valueless and this appears to be the easiest method of getting rid of it.

Thousands of tons of old grass are burnt every winter, whereas it could easily be cut (since this is usually a slack time of the year on the farm) and converted into valuable compost.

Moreover, the cutting of old grass, instead of burning it, also helps to improve the veld.

Preparation of Compost.

The following are the most important requirements for the making of compost:—

(a) *Organic material.*—Sources described above.

(b) *Nitrogen.*—Derived from manure and urine of farm animals, or used in the form of ammonium sulphate.

(c) *Moisture.*—Rainwater or water applied artificially.

(d) *Air.*—Introduced by turning the material if the latter has been trampled down too much or has become compacted.

Since conditions vary from farm to farm, it is inadvisable to lay down hard and fast rules for the making of compost. If farmers are acquainted with the general procedure, they can modify their methods to suit their own particular conditions.

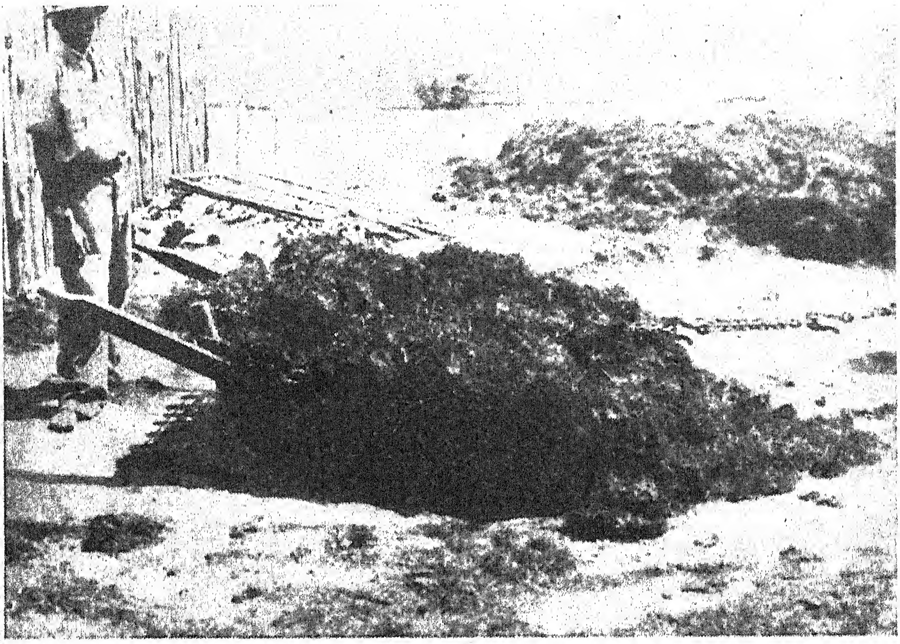
In the main, two methods are employed, viz:—(i) the kraal method in which animals are used for mixing the constituents, and (ii) the heap and trench method, in which animals are not used directly.

(i) *Kraal Method.*—This method is designed to eliminate manual labour as much as possible with a view to keeping production costs as low as possible. For this reason the compost is never turned over in the kraal or in the heap and is removed from the kraal only twice a year, namely in spring before ploughing operations are commenced or the reaping of wheat is begun in the Western Cape Province, and in autumn directly the hay and silage have been made and before harvesting is commenced, or ploughing starts in the Western Cape Province.

At the beginning, i.e. in spring or autumn, a layer of compost material approximately 9 inches thick is worked into the kraal. As

soon as the animals have trampled it sufficiently for it to be thoroughly mixed with manure, and it has been moistened by their urine, by rain or been watered by artificial means, a further layer of material is added. The process is continued until the layer of compost is from 2½ to 3 ft. thick.

The next step is to collect it with an ordinary dam scraper to which special steel prongs have been riveted, as described in the August, 1943, issue of *Farming in South Africa* or with a special



The Compost Scraper filled.

compost-scraper such as that designed at the Pasture Research Section, Döhne Experiment Farm.

(A description of this scraper is given elsewhere.)

The latter implement collects about 1,000 lb. of moist compost at a time.

The moist compost may be worked into heaps or stacks, six feet wide, 4 feet high and of any convenient length, or, as at the Estcourt Experiment Farm, Natal, onto platforms made of round wood. These platforms measure 18 by 25 feet and are raised approximately 1 ft. above the surface of the soil. If the compost is piled up to a height of about 4½ feet, such a platform holds approximately 20 tons of moist compost. The object of this platform is to facilitate aeration and thereby accelerate fermentation or rotting of the compost material.

In neither of these cases is it necessary to turn the compost again, and the compost can be carted direct from the heap to the land. In the first case (long heaps) the compost is ready for use after about 4 months, while in the second (platforms) after about two months.

If this method is employed, from 1 to 1½ tons of compost per ox or cow per month can be made if the animals are fed in the kraal and sufficient compost material is available.

(ii) *Heap or Trench Method.*—In this method the compost material is placed either in a heap, 5 feet wide, on the surface of the ground, or in a trench 3 feet deep and 12 feet wide, or partly in a trench (15 inches deep) and partly above the ground level and then subjected to the process of decomposition without first allowing animals to trample it in a kraal and to mix it with their manure and urine.

The procedure here is to spread the compost material in a layer one foot thick, and then to cover it with a 1 to 4 inch layer of kraal, stable or poultry manure, or with a mixture consisting of 20 lb. rock phosphate, 10 lb. ammonium sulphate and 50 lb. wood ash or agricultural lime per ton of dry material, plus a thin layer of soil. Every layer is thoroughly moistened with water. This process is repeated until a height of 3 to 4 feet is reached. In the very dry areas in the Union, e.g., in the vicinity of the large irrigation settlements, the material usually does not absorb enough moisture for the process if it is only sprayed. Consequently, the "soaking pit method" has been devised for these areas. The material is soaked in a pit of water for 2-4 days before it is placed in the heaps. During this soaking the material usually absorbs enough moisture for it to complete the process of decomposition.

Make sure that the layers are lightly stacked, otherwise the heap will heat up too slowly and the decomposition of the material will also take place too slowly.

The heap first heats up very rapidly and then cools down. If after 3 or 4 weeks the heap is still only lukewarm the material on the outside can be turned with a pitchfork so that it is now on the inside of the heap. If necessary, each layer of 12 inches should be thoroughly moistened again.

It may be necessary to turn the material once more (after 3 to 4 weeks) before the compost is ready for use on the lands. If this method is employed, the material takes about three months to decay sufficiently for use on the lands.

Production Costs.

Owing to differences in the various methods of making compost and the different wages paid to farm labourers in various parts of the Union the production costs of compost per ton also vary considerably.

It is also extremely difficult to calculate the costs exactly, since it is not always clear where to debit certain costs. For example, when surplus grass is cut from the veld and removed this procedure not only helps to improve the veld, but the material is also used for the compost.

Whatever our point of view may be in calculating the costs, the aim should always be to keep the production costs as low as possible. This can be done by handling the material as little as possible, as for example, during the turning of the material in the heap. Follow a method therefore, in which the compost will not have to be turned so often.

Application of Compost.

If the compost material is allowed to decompose properly, there is no danger of weed seeds being conveyed to the lands since the heat generated during the process of decomposition will destroy all seeds.

[Continued on page 708.

A Compost Scraper.

J. Krüger, Division of Soil and Veld Conservation, Pasture Research Station, Döhne, C.P.

TO facilitate the handling of compost and manure, and especially the strawy material in kraals, the officers of the above-mentioned experiment station have designed a scraper which has effected a great saving of labour. This scraper is very easy to handle and can collect up to 1,000 lb. of wet material at a time.

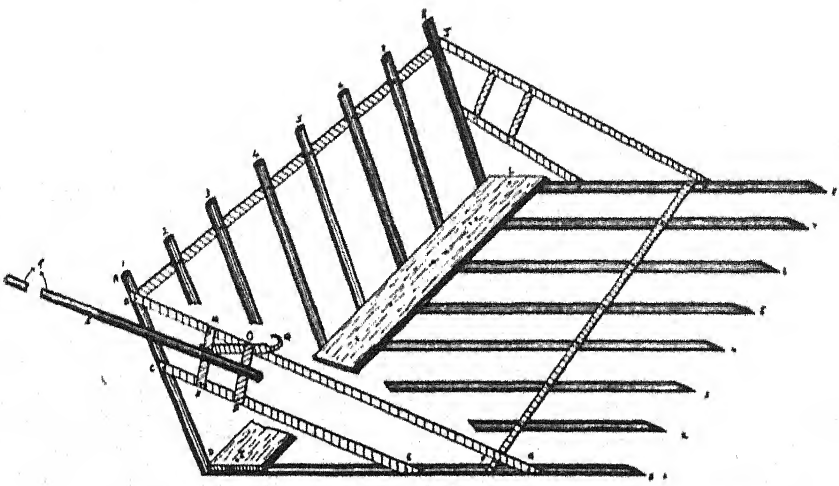
For the information of those interested, the following description of it is given:—

The following materials are required for making the simple compost scraper illustrated in the accompanying sketch:—

$2\frac{1}{4}$ in. boiler tubes: 8 lengths of 5 ft. 3 in.
$2\frac{1}{4}$ in. boiler tubes: 2 lengths of 3 ft. 3 in.
$\frac{1}{4}$ in. by $1\frac{1}{4}$ in. flat iron—21 ft.
$\frac{1}{4}$ in. by $1\frac{1}{4}$ in. flat iron—3 ft. 3 in.
$\frac{3}{8}$ in. by $3\frac{1}{2}$ in. rivets—40.
$\frac{3}{8}$ in. by $1\frac{1}{2}$ in. rivets—8.
$\frac{3}{8}$ in. by 8 in. round iron bent into U-bolts and threaded at both ends—4.
$\frac{3}{4}$ in. round iron rod threaded at both ends—3 ft. 9 in.
$\frac{3}{4}$ in. nuts with thread—12.
$1\frac{1}{2}$ in. by 6 in. hard wood—3 ft. 3 in.

Old scraps of iron should be used as much as possible, since they will serve the purpose and will help to keep the costs down.

Boiler tubes ADH, 1, 2, 3, etc., are bent at D so that AD = 21 in., DH = 42 in. and the angle is approximately 112°. To bend the tubes, they are tightly packed with sand and wooden plugs are driven in firmly at both ends. The tubes are then heated in a forge and bent to the desired angle at D. The plugs and sand are then removed, and points H 1, 2, 3, etc., heated and hammered flat for about 4 in. and corners cut away with a chisel; so that the points are about $1\frac{1}{4}$ in. wide.



This Scraper can collect up 1,000 lb. of compost at a time.

Make sure that all the tubes form an angle of the same size. This can be ensured by measuring them on one another during the bending process.

The next step is to drill $\frac{3}{8}$ in. holes in the two tubes intended for the sides at points B, C, I, E, F and G, so that the distances AB = $5\frac{1}{2}$ in., BC = 7 in., DI = 3 in., HG = 12 in., HF = 15 in. and HE = 24 in.

Holes $\frac{3}{8}$ in. in diameter are also drilled in the tubes on the lines.

(i) BJ which is $5\frac{1}{2}$ in. from point A.

(ii) IL which is 3 in., from angle ADH.

(iii) FK which is 15 in. from point H.

BG consists of $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. flat iron about 3 ft. 8 in. long. The length of this iron is, of course, determined by the size of angle ADH. At B, M, O and G, holes are drilled so that BM = 7 in., MO = $4\frac{1}{2}$ in. and G about 1 in. from the end.

CE consists of $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. flat iron about 2 ft. 4 in. long, with $\frac{3}{8}$ in. holes drilled as follows: CN = 3 in., NP = $4\frac{1}{2}$ in.

At MN and OP $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $5\frac{1}{2}$ in. flat iron is attached and also hook Q which is made out of $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. flat iron. The total length of Q is about 9 in.

Four U-bolts of $\frac{3}{8}$ in. round iron are made for fixing the handles R (approximately 3 ft. 3 in. boiler tubing) to MN and OP. It should be clear that four bolts and two handles are required.

Through S is placed a $\frac{3}{8}$ in. by 3 ft. 9 in. round iron rod threaded at both ends and with bolts on the inside and outside of the handles to pull them together and to keep them firmly in position.

BJ and FK consist of $\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by 3 ft. 3 in. flat iron with $\frac{3}{8}$ in. holes about $5\frac{1}{2}$ in. apart (provided the tubing is properly bent) and are riveted to the piping.

IL is a piece of hard wood, $1\frac{1}{2}$ in. by 6 in. by 3 ft. 3 in., in which $\frac{3}{8}$ in. holes are drilled $5\frac{1}{2}$ in. apart. The front of the board facing towards H is finished off with a slightly sloping edge so that the compost can slide over it. On top of IL is placed a $\frac{1}{2}$ in. by $1\frac{1}{4}$ in. by 3 ft. 3 in. flat iron, with corresponding holes, on which the rivets are riveted to fix the wood to the prongs.

Runners made of $2\frac{1}{4}$ in. by 3 in. by 6 in. hard wood and shod with old wagon-wheel tyres are attached on both sides, between the 2nd and 3rd prongs, at the bottom of IL by means of $\frac{3}{8}$ in. bolts or with rivets. These runners assist in lifting the scraper at D and in keeping points H closer to the ground, thereby facilitating the collecting of the compost. They also allow the scraper to slide more freely since there are fewer points resting on the ground.

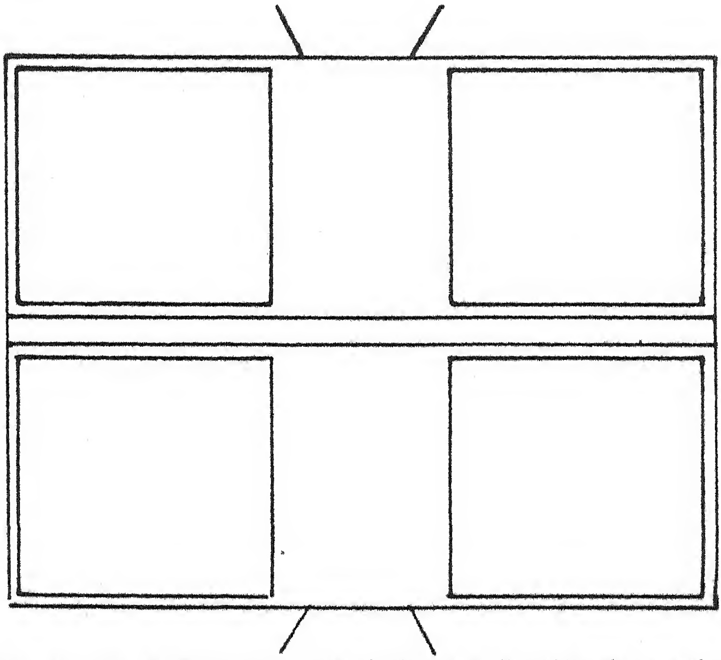
Inexperienced persons would be well advised to assemble the implement temporarily before riveting. Furthermore, attention must be drawn to the following: (i) It is essential to attach a tug chain to each hook; (ii) the compost must be loosened, for the implement to work efficiently; and (iii) the scraper should be handled by one man like an ordinary dam scraper.

Manure Disposal and Fly Control.

E. S. Dawson, Farm Manager, Agricultural Research Institute, Pretoria.

NORMALLY, manure and bedding as collected from stables contains insufficient water to produce enough fermentation for the breakdown of the fibrous material—a process commonly described as rotting.

Generally, where such manure is taken from the manure heap to the lands, it is merely mouldy and rotten only in those parts where the rain has sufficiently pentrated for thoroughly wetting the material.



Plan showing complete unit of 4 platforms with guides for scotchcart on both sides.

On the University Experiment Farm an effort was made to design, at moderate cost, a method by which thorough decomposition of the material from the stables could be accomplished and at the same time effect control of fly breeding. The discovery during preliminary trials that fly larvae drown rapidly in water assist materially in the scheme for fly control.

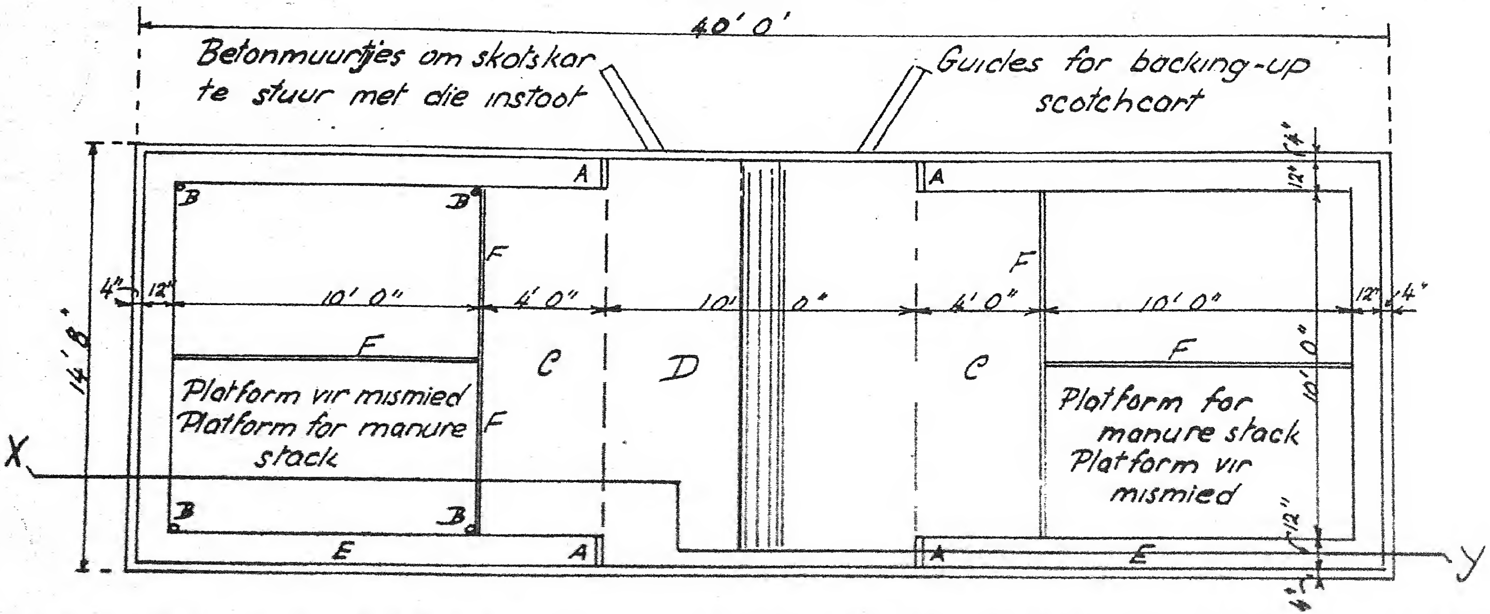
The Manure-disposal Fly Trap.

The basic requirements are: a level floor on which to build the manure stack, and a small draining floor, both surrounded by a *level* furrow which must *always* contain sufficient water so as to overflow into a sump. The whole must be constructed of concrete or other impervious material into which fly larvae cannot burrow.

The plan shown is largely self-explanatory. The method of procedure is:—

The fresh manure and bedding is brought from the stable and tipped direct from the scotchcart into the sump. Usually the bedding

PLAN.



A. Ramps across furrows 2 in. high to ensure presence of water.

B. Posts for guides at corners of platforms—Optional.

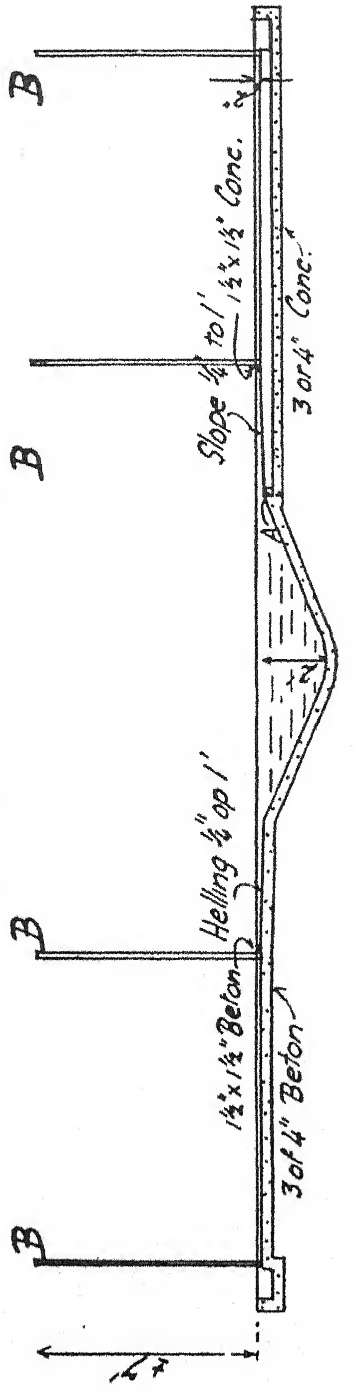
C. Draining floors sloping ¼ in. to the foot towards sump.

D. Sump.

E. Furrows, 3 in. deep. Kept full of water to level of ramps A. Inside walls of furrows should be smooth but no verandah is necessary.

F. Ridge 1½ in × 1½ in. between platform and draining floors to ensure presence of water at edge of stack so that the larvae cannot creep under stack [illegible]; also to devide platforms in half so that one half only could be used of the supply of manure is small.

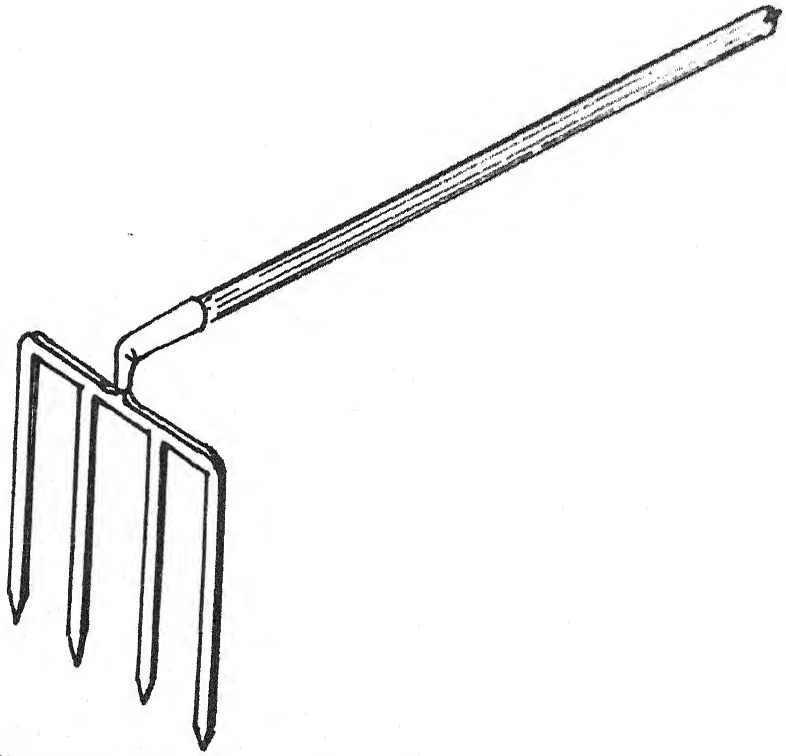
DEURSNEE X-Y.—SECTION X-Y.



is dry and bouyant, and a couple of logs are laid across the mass in the sump to increase submersion.

Each morning the previous day's cleanings from the stables, after soaking in the sump, is dragged from the sump on to the draining floor by means of a bent digging fork (see plan).

The material on the draining floor is then packed on to the manure floor or stack at any stage of the proceedings, i.e., immediately after it is taken from the sump or after one or more loads have been brought from the stables.



Digging fork with 6 ft. handle bent at right angles for pulling manure from sump to draining floor.

During hot weather it is advisable to pack it as wet as possible, but during wet weather it may be left longer to drain. Those portions which have not been thoroughly soaked are packed on the inside of the stack, only thoroughly wet material being used on the sides.

Fly Control.

The principle of fly control is that the larvae are driven by the heat of fermentation to the outside of the stack whence they fall clear into the furrows, which must always contain water along their entire length. Those larvae which fall onto the draining floor have no means of avoiding the sump or furrows. Larvae which are unable to find suitable refuge for pupation will pupate on a hard open concrete surface, and therefore the draining floors must be swept clean every morning. The furrows should also be swept clean daily, so that any floating debris and all larvae are swept into the sump. If

the dip is found to be insufficient to fill the furrows, these can be filled by means of a bucket with the fluid from the sump.

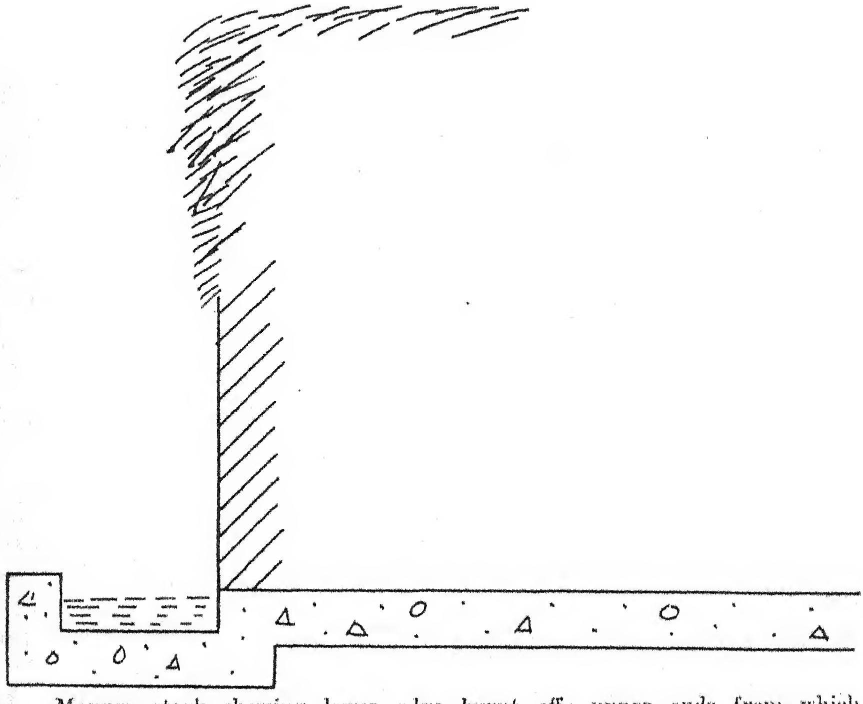
The method is not foolproof—under proper control and execution all the larvae are trapped and drowned, but if the stack should be carelessly built or allowed to get too dry on the outside, extensive pupating may take place on the outside edges of the stack.

The essentials for success are:—

(1) The stack must be well built, with sides vertical or slightly overhung, but not so much that the larvae can fall outside the furrow.

(2) The bottom edges of the furrow must extend right on to the edge of the concrete floor adjoining the furrows.

(3) When the stack is about 2 feet high, and as each successive 2 feet of material is added, the lower 1 foot 6 inches or so should be burnt off along the sides by means of a blow lamp. Thus the burnt portion rises as the stack is built up and is generally from 6 inches



Manure stack showing lower edge burnt off; upper ends from which larvae drop clear into furrows containing water. Note manure built flush with edge of furrow.

to 2 feet below the crest of the stack. The more recently added material in which fly breeding is active is not burnt and thus the ends of the bedding project some 2 inches beyond the burnt portion, so that the larvae can fall clear from these ends into the furrows.

If the material is as wet as it should be, the burnt portion will become smooth and almost shiny if the back of the pitch fork (not the bent digging fork) is passed over it in a downward direction.

Whilst building the stack it is advisable to dress the newly added outside material downwards with the pitch fork to avoid folds of grass, in the same way as dressing downwards the outside of a hay-stack.

Should the stack be badly built, either through building with inward sloping sides or allowing recesses to occur, the larvae will not fall clear into the water and will pupate in the sides of the stack. In such cases the only means of control is by repeated application of the blow lamp.

(4) It is absolutely essential that the material which is placed on the outside edges of the stack shall be well soaked.

Pig or poultry manure is placed on the insides of the stack without soaking.

(5) The rate of building (height) is important: if too slow, particularly during dry hot weather, the sides dry too rapidly; and if too fast, fermentation is likely to be retarded or arrested through lack of air. Hence the manure floors are bisected by a ridge of concrete, so that half of the floor may be used when only small quantities of material are available. The ridge is necessary to prevent larvae, which have dropped on to the vacant portion of the floor, from creeping under the stack to pupate.

When this procedure is adopted it is necessary to build the second half of the heap close against the completed first half, so as to ensure that there shall be no space between the two sections in which larvae can pupate.

Guide posts have not been found necessary at the main manure floors on this farm. Native labourers who are new to the work requires to be taught insistently to build vertically, the tendency being to pull in the sides of the stack.

A Kenya correspondent has stated that he has found it necessary to erect guide posts through which holes are drilled at intervals of 9 inches. On these posts he uses a collapsible frame, made of single depth 9 in. by $1\frac{1}{2}$ in. planks, which is lifted 9 inches at a time as often as may be necessary, and which rests on pegs inserted in the holes in the guide posts.

Size of Manure Pit.

A convenient unit of size consists of two pairs of floors or platforms with 2 sumps as shown in the plan.

It is found that each stack of manure when built originally to a height of about 7 feet, subsides to 4 feet in height after about 2 months time. The weight of such a stack of rotted manure is then in the neighbourhood of 10 tons Thus the unit suggested will hold 40 tons of rotted manure.

Should the farmer not be ready to apply the manure to the land when the floors are all filled, he can turn the two older, rotted heaps off the floors instead of carting it away, so as to make room for fresh material.

Although flies are not supposed to breed in material in which mentation is completed, yet it has been found that during summer tain amount of breeding does take place in such heaps which een turned off the floors, although it has long since ceased in sturbed heap on the floor. Thus it is advisable to have such rd to the lands before summer conditions commence.

A Farmer's Testimony.

I. Are our Arable Lands a National Asset?

WILL the application of mechanical anti-erosion measures justify the costs when erosion has advanced to such an extent that the cultivation of crops on these lands has become impossible? The answer is in the affirmative especially if it is borne in mind that the arable land available for crop production for the maintenance of a future large population is very limited. What there is, must therefore be maintained in good condition.

The following example demonstrates very forcibly what can be achieved by tackling soil erosion in a systematic and purposeful manner.

In the case of Mr. F. J. Erasmus, Brakdam, in the Senekal district, we have a typical example of a farmer whose future as an agriculturist was seriously threatened by soil erosion. This farmer spent sleepless nights trying to devise means to combat something against which he felt that he was helpless. His lands were being washed away, and, consequently, the capital and property on which he depended for providing the means with which to pay his interest and to discharge his debt on the farm he had acquired with such difficulty, were fast disappearing. This was not a case where the prices of products were making production impossible. Because certain lands had gone out of production owing to the impossibility of further cultivation, the other lands which could still be cultivated, were so overcapitalized that they could no longer yield a profitable return. In this case the farm was on the point of becoming a liability instead of an asset.

At his wit's end, Mr. Erasmus eventually turned to the Department of Agriculture and Forestry, which sent out an officer to investigate and to give the applicant advice.

On certain lands the position was extremely serious. Surface erosion had progressed to such an appalling extent that crop production of any kind had become out of the question. Dongas from 4 to 6 feet deep with absolutely perpendicular banks had been eroded so that it was quite impossible to cultivate the lands. At the same time these dongas formed excellent drainage channels along which thick muddy water was swept away after every little shower of rain.

The work of surveying the first contour banks was carried out on 2 December 1938, and although the applicant admits that he shrank from the task because its execution appeared a practical impossibility, he was compelled to start if from sheer necessity. The final inspection after completion of the works was carried out on 17 August 1939. All the contour embankments were made with an ordinary dam-scraper, since at that time it was the only implement at the disposal of the farmer. There were eight contour banks with their accompanying furrows, their total length being 6,370 yards. The completed works were valued at £158 by the Department. The contours covered an area of thirty to forty morgen; in other words, this land was bought back at £4 to £5 per morgen. At the time this amounted to about half the price of good land in that district. This reclamation work cost the State about £52 under its subsidy scheme—an investment which was fully justified in every respect.

The land which was so seriously damaged that nothing could be produced on it and which was therefore useless for all practical

purposes, has now recovered to such an extent that 200 bags of wheat were obtained from it during the past season. This crop alone which represents a value of roughly £350 is the result of that investment. In addition, the farmer has also had all the other crops which have been reaped since the work was completed.

After the completion of the first works, Mr. Erasmus was so convinced of the success of the undertaking that he immeditely, i.e., on 18 August 1939, made a start with further surveying. This time all sloping land was brought under the contour system, so that today all such soil on the farm is cultivated according to this system. The second part of work was completed much more quickly than the first.

Today Mr. Erasmus faces the future with confidence and attributes his present successful farming operations to contour banks. What this farmer has done, can also be done on many other farms.

(Submitted by J. J. Gertenbach, Soil Erosion Officer, Division of Soil and Veld Conservation.)

II. Contour Banks.

THE farm Peacehill, in the Fouriesburg district, is about 200 morgen in extent and the operations carried out on it include dairy, pig and poultry farming, as well as general crop production, primarily in the form of feed for the various farm animals.

Two years ago, when Mr. Wesley Gavin hired the farm, a start was made with the construction of contours on the lands. To-day practically all the lands are cultivated on the contour. During a recent visit to Peacehill of a group of farmers who wished to inspect the work, Mr. Gavin gave the following testimony before the farmers in favour of contour farming:—

(1) "On the contoured laid before you, erosion was truly alarming two years ago. Every time it looked like rain I held my breath. Recently, during a heavy downpour, the precipitation was 0·92 inches in 15 minutes, but I did not even take the trouble to go and look whether damage had been done because I knew that the lands were contoured and therefore safe.

(2) A few days ago I had a heavy downpour of 1·40 inches in less than an hour. While it was raining I put on my raincoat to go and see how a certain section of recently completed contours was working. While I was on the lands, it stopped raining. At the end of each contour, small streams of clear rainwater were running away. To me it was indeed a revelation. After about half-an-hour I walked home over the contoured land and found that only a few small pools of water remained standing in the contour furrows; the rest had soaked in. When I arrived at the land where the contours had not yet been completed but where the crop was planted on the contour, I encountered raging torrents of brown muddy water, so that I decided to complete the contours without the least delay.

(3) On this contoured land you can see for yourselves how well the maize has grown—the plants are about 2 ft. high. You may not believe me, but this land was planted during the drought when no other farmer in the neighbourhood could either plough or plant. The seed germinated immediately—and look at the excellent stand. That patch of maize over yonder which is now about four inches high, was planted on uncontoured land and even before the maize on this land, but the soil was so dry that the seed germinated only after the recent rains. The seed on this contoured land germinated readily because the soil caught up and retained enough rain during last

[*Continued on page 704.*

The Fertilizer Mixtures.

(Compiled by the Division of Chemical Services in Co-operation with other interested Divisions of the Department of Agriculture and Forestry.)

EVERY farmer should do his best to reduce his expenditure on fertilizers. It is not suggested that this should be done by using less fertilizer and starving the crops; but by doing everything possible to use only those fertilizers which are best suited to the particular case, no money need be wasted on inferior substances or expenditure incurred on costly ingredients of which his soil is not really in need.

The number of fertilizer mixtures containing more than one of the active constituents N, P or K has been limited to only eight as from 1 April 1942. These eight mixtures are designated by the letters A to H, followed in each case by numbers denoting the content of plantfood ingredients in the order N : P : K, according to international custom. The first number therefore indicates the percentage amount of N (nitrogen); the second the percentage P_2O_5 (i.e., phosphoric oxide to the extent in which this ingredient is soluble in a 2 per cent. citric-acid solution and therefore more or less available to plants); the third the percentage K_2O (potash). It will, therefore, be evident that *mixture* A (0:14:6), for example, contains no nitrogen, 14 per cent. available phosphoric oxide and 6 per cent. potash, whereas *mixture B* (2:12:6) contains 2 per cent. nitrogen, 12 per cent. phosphoric oxide and 6 per cent. potash. Owing to the experience in this country that in the vast majority of cases no crop can be successfully grown on our soils for any considerable time without liberal applications of available phosphate (P), all these mixtures contain large quantities of such phosphates.

The Mixtures.

Mixture A (0:14:6).—This mixture is recommended for crops known to have high potash requirements but where at the same time nitrogen is of little value or may even be harmful. The outstanding example of this is where light tobacco for flue-curing is grown on "black turf" and other heavy soils. As such soils are generally able to supply the tobacco plant with all the N it requires for healthy development, particularly if kraal manure, compost or greenmanure was applied to the previous crop, the addition of easily assimilable N in the fertilizer may give rise to a "heavy leaf" which will give an inferior cured product.

Leguminous crops, in particular lucerne, are great consumers of potash, but have the property of taking up free atmospheric nitrogen, satisfying their own requirements and enriching the soil with nitrogen compounds. As lucerne is commonly grown under irrigation on alluvial soils which are somewhat depleted in K, this mixture may frequently be very useful for this crop.

Sugar cane is a further example of a crop that frequently reacts to a K fertilizer. However, as it may be wasteful to apply easily soluble N compounds to this crop at planting, *mixture A* may also be recommended for plant cane.

Other crops known to have a high potash requirement include roots of various sorts and many vegetables, potatoes, sweet potatoes and most fruit trees, but as the N requirements of these crops are fairly high too, other mixtures are generally preferable. Where the practice is to give the necessary N as a top-dressing, or where the soil is particularly well supplied with nitrogen (e.g., vlei soils rich

in humus or lands where leguminous crops have been ploughed in, this mixture could also be considered for mangolds, peaches, etc.

Mixture B (2 : 12 : 6).—This Mixture can be recommended for the same crops as given for *mixture A* (0 : 14 : 6), but should be given preference if the soils are lighter (sandy). It is also very useful for these crops where for some reason or other it is considered advisable to give the young plant a small amount of easily soluble nitrogen (e.g., light tobacco and even lucerne on soils of low fertility). Should moisture conditions be unfavourable, this mixture (and to a lesser extent also *mixture A*) should preferably not be used, since the high combined percentage of N and K salts may give rise to " burning ".

Mixture C (2 : 12 : 2).—This mixture can be used for a great variety of crops, soils and conditions, especially where some doubt exists as to the adequacy of the water supply. It contains a relatively large amount of available P, but the small amounts of the other two important plantfood constituents may be very useful in furthering the initial growth, before the root system or other factors have succeeded in mobilizing the less available natural soil supplies for the use of the young plant. In general, however, it may be said that this mixture contains too little N and K to suit the requirements of crops that feed heavily on these constituents. Yet, if a fair amount of natural manure, which usually contains fair quantities of these elements, is also available, *mixture C* might be used with good results under dry-land conditions for crops such as potatoes and roots. Its main use, however, is for crops and on soils which do not have a particular need of N and K. It can be regarded as a substitute for a straight phosphatic fertilizer by all farmers who are not solely concerned with the immediate cash return given by the fertilizer, but are also desirous of protecting their soils against undue depletion. Where irrigation is practised the yields are commonly so high that the small quantities of N and K supplied by this mixture would be inadequate and therefore it is not recommended.

It may be mentioned here that stocks of ammonium sulphate, our best-known and most common N fertilizer, are very limited. *Mixture C* therefore usually contains its N in " organic form " (e.g. fishmeal). This N-compound possibly has certain advantages over the " mineral form " of N (sulphate of ammonia), but on the other hand, it is less readily available to the young plant. Thus, should an *immediate* action of the N-fertilizer be required, it would be advisable to use another mixture or a top-dressing of Chili salpetre or sulphate of ammonia.

Mixture D (3 : 13 : 3).—The Department considers that this mixture would usually be preferable to *mixture C* (2 : 12 : 2) where a " complete fertilizer for general use " is required. It ought to replace the latter for crops with only moderate requirements of N and K, but grown under irrigation. For crops which make great demands on the soil for these two constituents, this mixture may also be very suitable under dry-land farming conditions, where the moisture factor is not too uncertain. *Mixture D* is, to an even larger extent than *mixture C*, a basic mixture that is suitable for a wide range of crops and conditions. With the application of suitable top-dressings either the N or the K can be brought up to the level necessary for different crops or soils. If given after green-manuring or the application of compost it is suitable for crops with a high N-requirement. In conjunction with Karroo manure, it can be used for crops which are marked potash feeders, and with a good quality kraal manure or stable manure it would suit crops requiring liberal amounts of all three essential ingredients.

Mixture E (4 : 12 : 0).—This mixture was decided upon with the particular object of meeting the requirements of wheat in the western Cape Province and in the eastern Orange Free State, where experience has shown that the soils are still generally sufficiently well supplied with K to supply the needs of a fairly good crop. Naturally, the general rule also holds in this instance that steps must be taken to guard against undue soil depletion, and, therefore, a system of crop rotation should be practised which provides for a potash dressing in some form or other, whilst with the return of normal conditions this mixture should on occasion be replaced by one containing potash.

Mixture E could frequently be used with advantage for other grain crops, especially where these are grown for pasturing or forage and where leaf production is aimed at. For pasture and hay crops generally, as well as for maize grown under irrigation for silage, *mixture E* can be recommended with the proviso that many pastures (without legumes) will need additional N as a top-dressing.

Mixtures F (4 : 10 : 6) *and G* (6 : 10 : 3).—As the figures of composition show, both these mixtures are "complete fertilizers", containing large amounts of all three essential plantfood elements. They are, therefore, suitable for crops with high K and N requirements, and can be conveniently discussed together. Where large crops of this type are removed from the soil, e.g., under irrigation and regular rainfall, it is usually best to use one of these mixtures. Although they can frequently replace each other, especially if the prior treatment and use of the land is taken into account, it will be evident that *mixture F* is intended particularly for crops requiring a great deal of potash and *mixture G* for those showing a decided need for nitrogen.

In the first group fall those crops which have already been named under *mixture A* (0 : 14 : 6), with this difference that the soil must be definitely poor in nitrogen, e.g., soils that are very sandy or have become relatively exhausted. Examples are: light tobacco grown on poor sandy soils, potatoes grown without heavy application of manure, roots grown intensively as vegetables, orchards and vineyards lacking sufficient farmyard manure or greenmanure, ratoon sugar cane.

On the other hand, *mixture G* is particularly suitable for high-grade pastures in areas where the soil has been to some extent leached of K (mist belt). Frequently it is even essential to give nitrogen as top-dressing several times during the year. Grass lawns, flowers, leaf vegetables (greens) and citrus are further examples of crops that will usually respond well to this mixture.

Mixture H (8 : 10 : 0).—This type of mixed fertilizer is intended only for certain special uses, as it contains too high a proportion of N for most purposes. In those cases, however, where the crop requires exceptional amounts of N and the soil is well supplied with K, either naturally or as a result of previous heavy applications of Karroo or kraal manure, it may be used with advantage. It may thus replace *mixture G* (6 : 10 : 3) for established pastures or lawns. Frequently also, conditions are such in our citrus orchards and cane fields that for limited periods this mixture may be very useful.

Quantities of Fertilizers.

It is not possible to give precise instructions as to the sort or quantity of fertilizer that should be used in any specific case, since factors such as soil characteristics, cultivation, rainfall, climate, previous crops, etc., all have a marked influence.

Three of the factors that have a particular bearing on the *type* of fertilizer that should be used are soil fertility, moisture conditions and the use of natural manure. At this point it must be stressed once again that good organic material is still considered one of the best means at the disposal of the agriculturist to maintain the fertility of his soil. Unfortunately on most farms supplies of natural manure are very limited and the Department has, therefore, been active in making propaganda for several years now with a view to encouraging farmers to augment their supplies of animal manure by making compost. In general it may be said that where fair quantities of natural manure (including compost) can be used, a suitable phosphate is the only fertilizer required.

If the water supply is uncertain (e.g. very low or irregular rainfall) the general rule should be not to use mixtures containing 6 units or more of the soluble N and K compounds, or to use them only with great caution. This also applies to Karroo manure. In such circumstances phosphates only, or *mixtures C* or *E*, depending on the needs of the crop and the soil type, are preferable. However, as soils of very low fertility, such as coarse sands and other soils that have been greatly depleted, cannot be expected to give satisfactory yields with P alone, it will frequently be necessary to fertilize them with *mixtures C* (*or D*), *E*, *A*, according to the crop to be grown, where moisture conditions are not too good. Where the water supply is assured, preference should be given to *mixtures G*, *H*, *F* (*or B*).

Whereas it is the general experience that phosphates increase yields, an application of N fertilizer seldom gives an increased net income (established pastures and citrus are well-known exceptions), and K fertilizer, when used for crops other than tobacco and sometimes sugar cane and potatoes, still more rarely so. In times of scarcity or in other special circumstances the farmer would be justified to use phosphates only. As all crops, however, remove large amounts of N and K from the soil, it means that the soil is being robbed if these constituents are not returned and that sooner or later our descendants will have to pay.

As regards the *quantities* to be applied, the general rule is that the bigger the crop is expected to be, the more fertilizer must be given. Moisture conditions will be a very important factor in regulating the amount of fertilizer to be applied to a particular crop. Different crops have markedly different requirements, and whilst maize grown under dry-land farming conditions does not need more than 200 to 400 lb. fertilizer per morgen, a tomato crop may find 1,600 lb. per morgen barely enough.

How to Obtain Advice.

The efforts of the Department to assist farmers to save money on their fertilizer bill will be largely nullified if they do not take the necessary steps to acquaint themselves thoroughly with the meaning of the names of the *mixtures*, with the particular purposes for which they are considered suitable, with the special needs of their soils, and with the general requirements of the types of crops they wish to grow. To take a case in point, a farmer who buys a mixture containing a high percentage of potash for a crop like mealies that can usually do quite well without it, not only wastes his own money, but deprives the tobacco farmer of the potash which is an essential constituent of a tobacco mixture.

The Department finds it necessary, therefore, under the stress of existing conditions, to repeat an earnest appeal to farmers to study the composition of *mixtures* carefully before placing orders. Should they not fully understand the names and figures or if they are

in doubt as to the needs of their soils and crops, they are reminded that the whole machinery of the Department is still, as in the past, at their disposal. In the first instance the farmer should address himself to the extension officer, or college of agriculture, or experimental station dealing with the special branch of agriculture concerning which advice is needed (e.g. deciduous fruit, pastures, tobacco). In addition, the Head Offices of the Department in Pretoria and of the various Divisions dealing with soils, fertilizers and cultivation of crops, such as Chemical Services, Horticulture and Animal and Crop Production, will always be ready to give fuller information concerning these mixtures and to advise farmers generally on fertilizer matters.

Farm Compost:—

[*Continued from page* 688.

When the compost is dumped on the lands, it should not be scattered and then left exposed to the mercy of the wind and weather for days, as often is the case, but should be ploughed in immediately. If this is not done, the valuable nitrogen content of the compost will be lost for the ensuing crop.

From 10 to 20 tons of compost, depending on the moisture content and fertility of the soil, must be applied per morgen if favourable results are to be expected. The accompanying photo clearly shows the influence of an application of 10 tons of compost per morgen (right) on maize, against 400 lb. superphosphate per morgen (left) at Towoomba, Warmbaths, Transvaal.

Owing to the difference in the composition of compost material due, for example, to the feed which animals use for making compost, the method of preparation, etc., considerable differences in the chemical composition of the final product must also be expected.

In the following table a few figures are given to indicate how the chemical composition of compost may differ:—

Origin of Samples.	Per cent. available Phosphate.	Weight of available Phosphate in lb. per ton of Dry Compost.	Nitrogen.	Weight of Nitrogen in lb. per 10 tons of Compost.	Per cent. available Potash.	Weight of available Potash in lb. per 10 tons of Dry Compost.
Estcourt (Natal)...	2·03	46	1·78	356	1·48	296
Leeuwkuil (Vereeniging)	0·21	42	1·48	296	1·79	358
Towoomba (Transvaal)	0·17	34	1·72	344	1·28	256

If it is borne in mind that one bag of 17·1 per cent. superphosphate contains 34·2 lb. phosphate, one bag of ammonium sulphate 42·2 lb. nitrogen, and one bag of potassium chloride 120 lb. potash, the value of compost is shown up much more clearly.

Although the figures for some of these analyses may seem low, it is clear that if 10 tons of dry compost (equal to about 20 tons of comparatively moist compost) are applied per morgen, considerable quantities of plant nutrients in addition to the desired organic material are introduced into the soil. These plant nutrients will have a most beneficial effect on the ensuing crops. Farmers should, therefore, not allow a scrap of organic material to go to waste, but should convert it all into compost. Keep production costs as low as possible, and plough the compost under immediately after is has been strewn over the land.

The Role of Fertilizers in the Maintenance of Soil Fertility:—

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lizing substance but rather as a soil conditioner. Lime is used to reduce excess acidity of soils. Although acid soils are not very common in the Union, there are cases where the application of lime is imperative. Legumes are generally very sensitive to acid and, therefore, yield the best crops on sweet soils. Where lucerne has to be grown on slightly acid soil, it is also advisable to lime the soil first.

Further Requirements.

In the maintenance of soil fertility and the production of maximum crop yields, fertilizers are merely an aid which should go hand in hand with the use of good seed, thorough cultivation of the soil, the adoption of effective systems of rotational cropping, weed control and soil erosion, and the application of kraal manure and compost where its use is economical.

It is impossible, of course, to make any general recommendation in this article as to the best kind of fertilizer or mixture to apply under all soil and climatic conditions. Readers desiring further information are, therefore, requested to address inquiries to the Principal of the College of agriculture serving their particular area.

A Farmer's Testimony:—

[Continued from page 698.

season. Let us walk over to that land, and in the meanwhile I want you to take note of the difference in soil structure between the two lands. The soil on this land which was ploughed during the drought, has as you can see, been finely broken up by the harrow, but on the other uncontoured land you will have to walk very carefully if you don't want to break a leg over the clods.

(4) I have four native families on Peacehill. Every year they are allowed to choose where they want their plots of maize. This little land, where the maize is only 4 inches high, was always regarded as the best on the farm with the result that they would never dream of choosing their plots anywhere else. As for this sloping land, they never have given it a moment's consideration, but last year when they were again allowed to choose they all selected plots on the contoured sloping land where, as you have seen, the maize is already 2 feet high. Now you can judge for yourselves whether the natives are as stupid as we often think they are.

(5) Peacehill is a hired farm. It may be that I will have to leave the property tomorrow, but I have seen such direct and immediate results obtained from contour farming that I have decided to become a hundred per cent. contour farmer as soon as possible. I was always under the impression that years had to elapse before results could be expected from contour farming, but now I have seen that immediate results can be obtained so that even a lessee can benefit thereby."

Peacehill is by no means a model contour farm, but the definite results which this farmer has experienced in such a short period provide ample proof that contour farming can be a practical profitable enterprise on every farm.

(Submitted by J. P. J. van Vuren, Extension Officer, Division of Animal and Crop Production.)

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 SEPTEMBER 1943 No. 253

CONTENTS

* Price Review for July, 1943.

SLAUGHTER STOCK.—Supplies were moderate to limited and rationing had often to be applied. Nevertheless the position as regards mutton was much better than during June. Ordinary primes on the Johannesburg market were 37s. 5d. per 100 lb. live weight, good mediums 34s. 6d. and compounds 27s. 6d.

With a stable demand prices of slaughter sheep remained practically unchanged.

Grains and Feedstuffs.—Consignments of hay diminished and especially oat hay and teff were very scarce and experienced a strong demand. Supplies of dry beans, dry peas and kaffircorn were also smaller and prices advanced. In the case of kaffircorn K.1 and K.2 increased from 21s. 4d. and 22s. 1d. per bag free-on-rail, to 24s. 6d. and 25s. 6d. per bag respectively.

Potatoes—Offerings were somewhat smaller at the beginning of the month on account of heavy rains. Thereafter supplies gradually increased and towards the end of the month there were even carry-overs on the Johannesburg market and prices were on a lower level. On all markets the average prices for the month, however, were higher than for June. National Mark offerings were exceptionally small. On the Johannesburg market Transvaal No. 1 realized 16s. 4d. per bag as against 12s. 11d. in June, and National Mark Grade 1, No. 2 increased from 19s. 9d. and 19s. per bag to 21s. 5d. and 21s. 4d. respectively in June.

Onions.—Supplies, especially of Cape onions, decreased further during the month and prices showed a further advance. e.g., Cape onions on the Johannesburg market from 17s. 4d. per bag in June to 20s. 2d. in July, and on the Cape Town market from 14s. 3d. to 16s. 5d.

Tomatoes were still exceptionally scarce during the month. Larger consignments Transvaal tomatoes were on all markets but the

* All prices mentioned are average.

quality sometimes left much to be desired and prices were sometimes adversely affected. On the Cape Town market tomatoes declined from 4s. per tray to 3s. 10d. in July and on the Durban market from 3s. 6d. to 2s. 1d.

On the Johannesburg market, however, the average price for the month shows a rise from 3s. 8d. to 4s. 5d. per tray, while National Mark tomatoes which were exceptionally scarce, increased from 7s. 2d. to 7s. 11d.

Vegetables.—Heavy rains and general unfavourable climatic conditions caused offerings of vegetables to be mostly very small and high price levels were maintained. Cabbage and cauliflower were the most important vegetables on the market, while offerings of green beans and peas from the Lowveld also increased.

Fruit.—Supplies of navel oranges diminished quickly on the markets. The demand was sharp and buyers had sometimes to be rationed at fixed prices. Valencias and seedlings, on the other hand, experienced a much poorer demand. Supplies of deciduous fruit consisted practically only of cold storage apples. Except for pawpaws, other kinds of tropical fruits were supplied very moderately.

Eggs.—Appreciably larger supplies reached the trade and prices in general declined, e.g., new laid on the Johannesburg market from 2s. 3d. per dozen in June to 1s. 9d. in July and on the Durban market from 2s. 9d. to 2s. per dozen.

Index of Prices of Field Crops and Animal Products.

This index, as shown elsewhere, again advanced somewhat during the month, viz., from 150 in June to 153 in July.

The most important changes were in:—

(*a*) Hay which increased from 165 to 174.

(*b*) "Other field crops" (i.e. potatoes, sweet potatoes, onions and dry beans) from 165 to 186.

(*c*) Dairy products which advanced from 163 to 176 as a result of an increase of 2d. per lb. in the subsidy paid on all butterfat delivered to creameries from 1 July 1943.

(*d*) Slaughter stock which increased from 166 to 182 as a result of an increase in prices of slaughter cattle during the month.

(*e*) Poultry and Poultry Products which decreased from 202 to 185 as a result of a further drop in the price of eggs.

Indexes of Prices Paid for Farming Requisites.

From these indices, as shown elsewhere in this issue, it appears that only the following showed any noteworthy change for the quarter ending 31 July 1943:

(*a*) Feedstuffs which increased from 151 to 157 mainly as a result of an advance in the price of hay and mealies.

(*b*) Dipping and spraying materials which increased from 123 to 131.

(*c*) Building material which increased from 176 to 179.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON (1st July to 30th June).	Summer Cereals. (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Stock. (e)	Dairy Products. (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
Weights.									
1936-37	19	13	2	3	34	6	17	6	100
1937-38	118	86	94	93	122	86	89	98	106
1938-39	89	106	112	118	98	112	105	107	101
1939-40	92	107	96	89	79	102	106	94	93
1940-41	86	106	77	93	116	105	106	89	104
1941-42	109	113	106	159	103	108	110	112	109
[illegible]	121	132	145	205	101	131	134	163	124
1943—									
January	160	154	132	113	115	139	165	150	141
February	163	154	130	112	115	139	156	179	142
March	161	154	142	119	115	139	160	216	145
April	159	154	142	140	116	139	163	262	148
May	169	154	144	155	116	163	165	316	156
June	169	154	165	165	116	163	166	202	150
July	170	154	174	186	116	176	182	185	153

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay.
(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins.
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls, turkeys and eggs.

Index of Prices Paid for Farming Requisites.

Year and Month.	Implements. (a)	Fertilizers. (b)	Fuel. (c)	Bags. (d)	Feeding Stuffs. (e)	Fencing Material (f)	Dipping and Spraying Material. (g)	Building Material. (h)
Base—								
1936-38	100	100	100	100	100	100	100	100
1939	105	106	98	146	90	114	100	103
1940	120	139	117	171	95	176	112	124
1941	124	170	124	175	109	208	115	144
1942—								
January	121	146	125	188	115	229	117	164
April	122	146	134	194	127	228	117	165
July	124	146	146	220	147	231	118	167
October	124	146	152	224	145	230	118	171
1943—								
January	126	146	154	232	145	238	123	174
April (j)	126	146	154	234	151	238	123	176
July	126	146	156	235	157	238	131	179

The following is the composition of the above groups. (The items are weighted according to their respective importance) :—

(a) Ploughs, planters, seed drills, harrows, cultivators, ridgers, mowers, binders-hay rakes, silage cutters, hammer mills, separators, windmills, shares, land sides, mouldboards, knife, pitman, guard.
(b) Superphosphate, ammonium sulphate, potash, muriate, bonemeal.
(c) Petrol, power paraffin, crude oil, grease, lubricating oil.
(d) Woolpacks, grain bags, sail twine, binder twine.
(e) Mealies, bran, oats, lucerne, groundnut-oil cake, bonemeal, salt.
(f) Fencing wire, standards, baling wire.
(g) Bordeaux mixture, lime sulphur, arsenate of lead, cyanogas, Cooper's sheep dip, Little's dip, Tixol cattle dip.
(h) Corrugated iron, deals, cement, lime, flooring boards.
(j) Preliminary.

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb. (a) Johannesburg. N.M. Prime.	(a) Johannesburg. Ordinary Prime.	(a) Johannesburg. Good Medium.	(a) Johannesburg. Com-pounds.	(b) Durban. Medium.	(b) Durban. Com-pound.	Pigs per lb. Live Weight. Johannesburg. Porkers, Prime.	Johannesburg. Baconers, Prime.	Johannesburg. Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938–39	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940–41	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941–42	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·0	4·5
1942—									
January	62 3	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
October	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·6
November	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2
April	65 6	60 8	55 8	43 4	42 1	33 11	6·9	9·1	6·5
May	65 0	59 11	55 3	43 9	42 6	37 6	7·6	8·7	6·6
June	36 3	32 7	29 7	23 1	42 6	37 0	8·3	8·7	7·4
		No. 1.	No. 2.	No. 4.					
July	40 9	37 5	34 6	27 6	45 6	41 0	8 4	8 6	7 1

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.
(d) From June, 1943, prices are quoted per 100 lb. live weight, and grades No. 1, 2 and 4.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June to 31st May).	Johannesburg. Merino Wethers. Prime.	Johannesburg. Merino Wethers. Medium.	Johannesburg. Persians and Cross Breds. Prime.	Johannesburg. Persians and Cross Breds. Medium.	Cape Town. Merinos. Prime.	Cape Town. Merinos. Medium.	Cape Town. Capes and Persians. Prime.	Cape Town. Capes and Persians. Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938–39	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940–41	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941–42	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942—								
January	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March	9·6	814	8·8	7·9	9·6	8·8	9·3	8·8
April	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
October	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·[illegible]
February	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·[illegible]
March	11·5	9·8	9·0	7·3	11·7	10·6	11·1	10·[illegible]
April	12·0	10·2	9·5	7·7	12·4	10·9	11·6	10·[illegible]
May	12·0	10·3	9·6†	7·9†	11·1	10·1	11·1	10·3
June	11·4	10·2	10·4	9·2	10·8	10·5	11·0	10·2
July	11·4	10·3	10·3	9·3	11·4	10·2	11·2	9·9

* As sold on the hoof. Reported by Meat Control Board.
† As from June "other hamels".

CONTENTS

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[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Horse Improvement Scheme "B" (Farmers).

SERVICE SEASON 1943-44.

During the service season 1 October 1943 to 15 January 1944, the following stallions will stand at stud for service of farmers' mares at the undermentioned *Institutions*:—

1. College of Agriculture, Grootfontein, Middelburg, C.P.: Percheron
2. College of Agriculture, Glen, O.F.S.: Percheron and Thoroughbred.
3. College of Agriculture, Potchefstroom: Percheron, Thoroughbred and Donkey Jack.
4. College of Agriculture, Cedara, Natal: Percheron.
5. College of Agriculture, Stellenbosch-Elsenburg: Percheron.
6. Veterinary Research Station, Ermelo, Tvl.: Percheron and Thoroughbred.
7. Pretoria University, Pretoria: Percheron.
8. Dohne Experiment Station, P.O. Dohne: Percheron.
9. Oakdale School of Agriculture, P.O. Riversdale: Percheron.

The Pretoria University will accept a limited number of mares under Scheme B for the Percheron stallion maintained there. Only mares on heat will be accepted, and in no cases can they be kept longer than three days, at 1s. per day.

The main features of the Scheme are:—

(*a*) A dourine free certificate must be submitted with the application and farmers should have their mares tested early.

(*b*) Only halter-tame mares and jennies of approved type and in satisfactory condition will be accepted—mares standing 14 hands and over and jennies 13 hands and over.

(*c*) Railway charges are charged for the forward journey only.

(*d*) The service fee is £1. 1s. and maintenance costs are 2s. 6d. per week. An additional charge of 1s. per day is made for stabling if desired and available.

Full particulars of stallions and a copy of conditions of the Scheme are obtainable from every stud station.

Brine in Refrigerating Systems.

IN view of the critical position in regard to Sodium and Calcium brines, and also in view of the need for reducing corrosion in refrigerating plants to a minimum, the Officer-in-Charge of Dehydration and Cold Storage, P.O. Box 3, Cape Town, has drawn up notes on the uses of brine in refrigerating plants, and methods of testing such brines.

Readers who are interested in the subject can apply to the above address for copies of the notes and also obtain particulars about advice and assistance on any problem connected with the use of brines.

New Bulletins for the Farmer.

The following Bulletins have just been published and a[illegible]nable fr[illegible] The Editor, Department of Agriculture and Forestry, Pret[illegible]

Bulletin No. 240.—" Soya Beans in S.A.": Price 6d.

Bulletin No. 192.—" Control of Household Insects in S.A." [illegible]tion[illegible] Price 6d.

Bulletin No. 111.—" Dairy Farming " (Fifth Edition): Price

Bulletin No. 126.—" Poultry Houses ": Price 3d.

FARMING IN SOUTH ... AFRICA

Vol. 18 OCTOBER 1943 No. 211

Editorial:

Bush and Weed Encroachment.

As is indicated elsewhere in this issue, a serious pasture problem has arisen in parts of the northern Transvaal as a result of dense thorn-bush encroachment over extensive areas formerly covered with grass.

Side by side with this new danger from the much-vaunted bush-veld is the older threat to our pastures which has already existed for some years in the eastern Cape Province, where large patches of potential grazing have been rendered valueless as a result of the enroachment of inferior plants like rhenosterbush, harpuisbos, prickly pear and jointed cactus. In so far as the last mentioned two pests are concerned, comprehensive and expensive control measures have been applied for some time past, but still the menace continues. This Division of the Department, which is charged with the task of soil and veld conservation, considers itself in duty bound to sound a timely warning to farmers against the dangers of further encroachment by these undesirable plants, this process being the direct result of incorrect veld utilization. Not only do these plants have an exceedingly exhaustive effect on the soil, but by ousting the desirable grasses, their presence also promotes trampling of the soil and the increase of "steekgras", thereby making the veld unsuitable for stock.

If these inferior plants are allowed to multiply unchecked, they will ultimately produce a physiological change in the nature of our veld comparable in seriousness to that brought about in some areas by Karroo-bush encroachment. In parts of the southern Orange Free State some farmers, with a view to "taming" their grass-veld for sheep-farming, actually encouraged Karroo-bush encroachment. For a while their sheep-farming flourished, but unfortunately this "taming" process is fraught with other difficulties, and the farmers found that, inter alia, the vegetal cover of their soil was deteriorating. And so the forces of erosion were unleashed. Once started, this process is difficult to arrest, and to-day the worst examples of erosion are to be found in the Karroo itself and in the lower-rainfall areas which had originally been grassveld.

In the high-rainfall areas incorrect methods of veld management also produce a change in the vegetal cover. When, as a result of injudicious grazing, untimely veld-burning and general misuse of the veld, the better types of grass disappear, their place is taken by inferior plants, and sometimes even by useless weeds. A marked diminution of the grazing value or carrying capacity of the veld ensues and stock-farming suffers in consequence.

Examples of the effects of injudicious veld utilization are legion. The following may be cited as outstanding instances: the disappearance of permanent grasses in the Karroo; the increase in "steek-

gras "; the diminution of the most nutritious bushes, accompanied by an increase in inferior bushes, such as bitterbos (*Chrysocoma*); the encroachment of the Karroo-bush on grass-veld in areas adjoining the Karroo, with the attendant evils of "steekgras" and accelerated erosion; the reduction of the grazing value of the veld in the higher-rainfall areas where good grass varieties are sometimes ousted by inferior types and weeds; the spread cf thorn-trees, rhenosterbush, harpuisbos and other undesirable plants on the veld, constituting a threat even to those portions which so far have escaped impairment.

A practical farmer has little reason to be proud of the results of incorrect veld management; nor can he afford to continue with the methods which have produced these results. Once again, therefore, the Division wishes to make an urgent appeal to farmers to watch over their soil and veld— the source of their own livelihood, and the heritage cf their children. The application of improved methods of veld utilization will do more than keep the above evils in check—it will place the entire farming enterprise on a more profitable basis.

(Dr. J. C. Fick, Senior Professional Officer, Division of Soil and Veld Conservation.)

Twenty Bags of Maize per Acre.

FRIEDEL SCHRAMM, a 14-year-old member of the Verden Agricultural Club, Elandskraal, Helpmekaar District, has succeeded in obtaining the extraordinary good crop of 20 bags of shelled maize per acre from his plot. With an application of six wagon loads (probably small wagons) of kraal manure and 100 lb. of bonemeal and superphosphate the plot was planted with Ladysmith-Pearl maize crossed with Rooistrenk (Silver King), and yielded cobs with 14 to 20 rows. The plot consisted of well-prepared dark heavy loamy soil on which cowpeas had been grown previously. The rainfall amounted to 44 inches for the season, the normal rainfall being about 35 inches. The plot was excellently cultivated and the cost of production was 4s. 8d. per bag; his net profit worked out at £11. 17s. 4d. per acre. Rather too much native labour was employed, but otherwise all the requirements of this project were properly carried out.

This exceptional result has caused considerable interest in the district, and half of the crop has already been booked by local farmers for use as seed. According to local farmers this crop exceeds anything raised so far in this area of Natal.

In this connection it should be pointed out, however, that the first cross of any two seeds usually gives good results, but it does not necessarly follow that subsequent plantings of such seed will give equally good results. Also in this case it must be pointed out that the seed used was not the only factor that determined the size of this outstanding yield.

(Submitted by B. Schroeder, Chief Leader of the Club.)

The Lay-out of a Piggery.

E. D. Adler, Lecturer in Animal Husbandry, College of Agriculture, Glen.

CLIMATIC and farming conditions in South Africa vary greatly in the different districts.

There are, also, various methods of pig farming: some farmers may breed pedigree pigs, while others are purely commercial porker and baconer producers. It is thus impossible to give a lay-out which will suit all conditions.

There are, however, three main systems of pig production, e.g. (1) The Intensive, (2) Extensive or Free Range, and (3) Semi-Intensive or combination of (1) and (2).

The intensive system is one where the pigs are kept in a limited space and are confined to the sty.

Owing to the danger of measles, the free range system has limited possibilities in our country with its large native population.

The semi-intensive system generally suits the average farmer who desires to carry on a pig-production proposition which will fit in with the rest of his mixed-farming activities.

Whichever system is applied, the lay-out of the piggery requires careful consideration.

Choice of Site.

Choose the best site. Some people have the mistaken idea that pigs must necessarily be placed in the wettest and most low-lying locality, as for instance in a vlei. Nothing can be further from the truth. Choose a site which is well-drained, well-sheltered, cool in summer and as warm as possible in winter—the sort of place where you would not mind building your own house.

Sties should be built to face the direction from which the least cold weather comes and in such a way that the greatest benefit can be obtained from the rays of the sun during winter. In most parts of South Africa a north or north-eastern aspect is desirable.

If there is a choice of soil type, it is best to choose a coarse sandy loam or even a gravelly soil. A very heavy clay soil is not desirable.

The position of the piggery in relation to the farm yard, feed and water supplies, dairy, etc., must be considered.

A piggery hidden away in a remote and at times almost inaccessible place will seldom be an asset to the farmer. The saying that "the eye of the master fattens the kine" is true also for pigs.

The lay-out should be such that working costs are kept to a minimum, and the possibility of expansion at a later date should be borne in mind.

Type of Buildings.

Elaborate buildings and expensive materials are not necessary. Use suitable material which is most plentiful and easily obtainable in the particular area. For example, thatch is often cheaper than corrugated iron for roofing. In very hot areas thatch is often preferable to iron for this purpose. Stone or split-poles may sometimes be used for the walls of shelters instead of bricks or corrugated iron. Whichever system of lay-out, or whatever materials are used

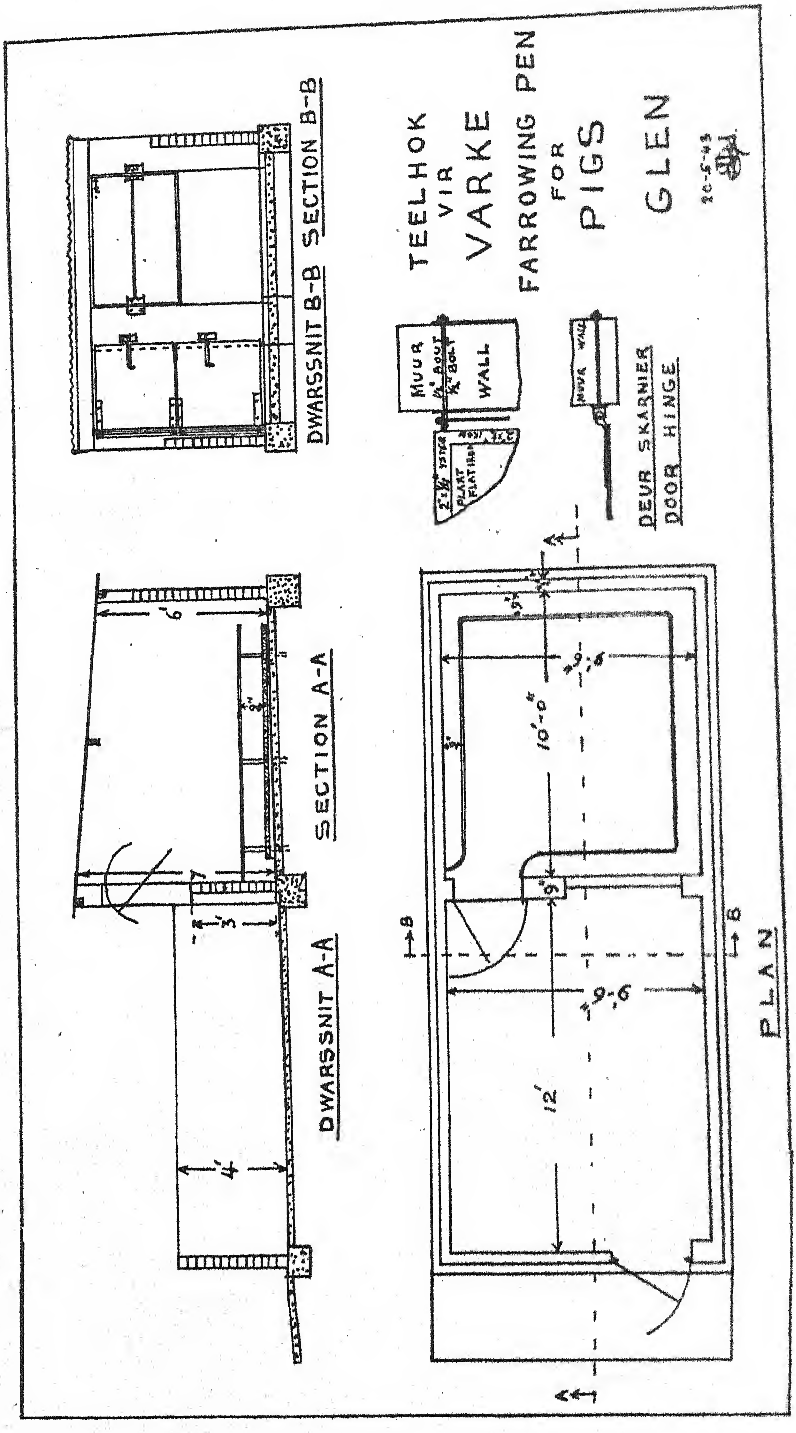


Fig. 1.—The ideal farrowing pen.

particular attention must be paid to the construction of the farrowing pen. The most important factor in economic pig production is the sow's regular farrowing and raising of sufficiently large litters. A sow must be absolutely comfortable during and for a few weeks after farrowing. If she is placed in a pen which is cramped, too cold and wet or too hot and stuffy, she will be restless and will probably lie on and kill most of her litter during the first three days after farrowing.

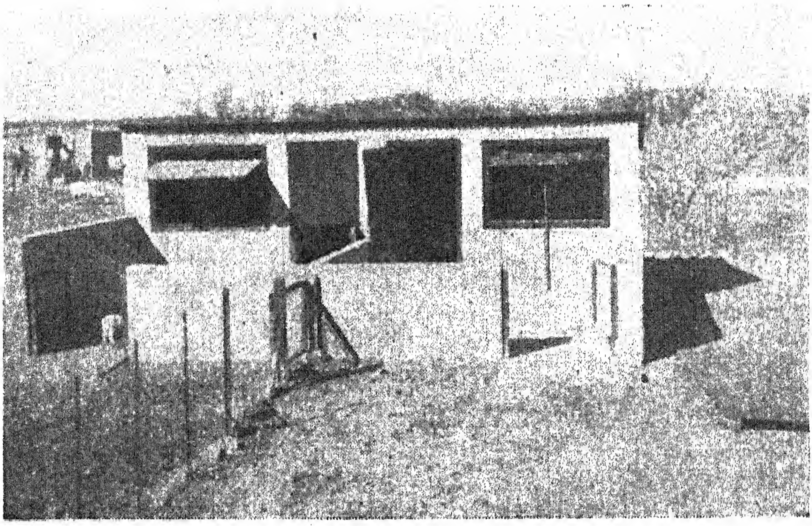


FIG. 2.—Ideal farrowing houses showing board floors outside.

It is suggested that the farrowing pen be constructed as illustrated in Fig. 1.

This type of pen can be used under any system. The floors must be made of cement-concrete and sloped to an outside drain so that washing and disinfecting can take place regularly.

Unfortunately such a concrete floor is too cold. If a large quantity of bedding is provided the new-born piglets may be too weak to get out of the hollow made by the sow and are easily killed when the sow changes position. It is, therefore, recommended that the farrowing pen be provided with a false board floor. This board floor is made in two sections, which can be lifted and removed when the house is to be washed and cleaned. This wooden floor should occasionally be put outside to dry and treated with substances such as carbolinium and tar.

The fact that a minimum of bedding is required with such a false board floor is a great advantage.

The roof of the farrowing house in particular and of all pens in general, should not be so low that it necessitates a man stooping and crawling to get under it to handle the sow and piglets, or to clean out the sty. Such low-roofed hutches are generally dark, damp, dirty, badly ventilated, and too hot in summer or too cold in winter.

In very warm areas, or where sows are allowed to farrow only during summer, the upper door and swivel window of the farrowing house, as shown in figs. 1 and 2, are not essential. On the other

hand, if violent rain storms are experienced the door and window are often very useful.

Note that the farrowing pen is supplied with a farrowing rail which must be 9 inches from the wall and 9 inches from the board floor.

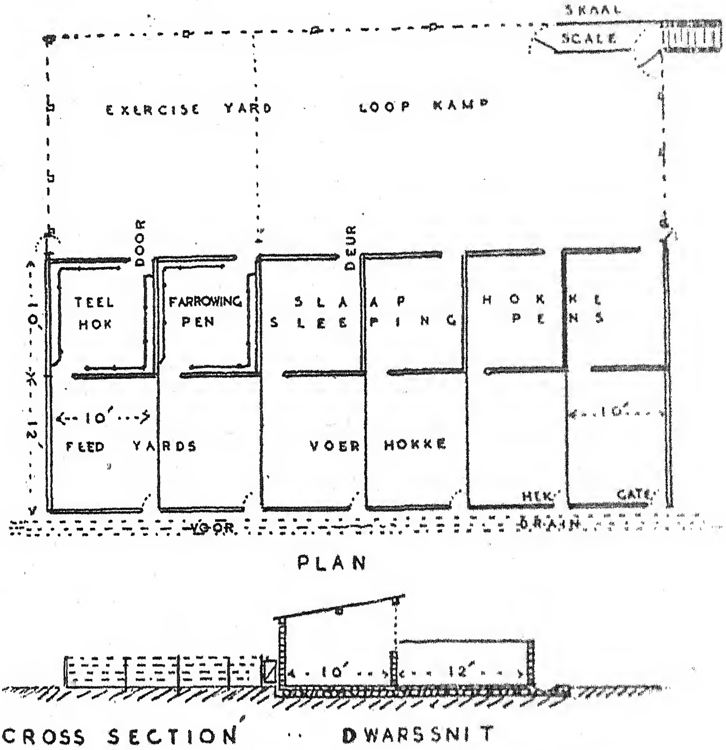


FIG. 3.—Suggested Lay-out of Piggery (Intensive System).

The layout of the piggery and types of buildings to construct will depend on the system of pig-farming.

A few examples are given:—

The Intensive System.

Fig. 3 is almost self explanatory.

The farrowing pens should be constructed as already explained and illustrated in Figs. 1 and 2, with the exception that a dor is made in the back wall of each pen so that the pigs can have access to an exercise yard. In hot areas a wallow and a few shady tres in this yard are ideal.

The other sleeping pens do not require the swivel window or door between sleeping pen and feed yard, and can be made as large as desired.

The stud breeder who desires to give special attention and feed to small groups of animals of different ages, sexes or breeding will need to construct a large number of relatively small pens. The commercial farmer who caters for the porker and baconer markets may find relatively larger pens more useful. It is inadvisable, however, to make these pens too large. Even where pigs are fattened

on a very large scale it is advantageous to have sufficient pens so that animals can be grouped and fed according to age, size and condition.

A pen of 10 by 10 feet is the most useful and can be used for farrowing or other purposes. As many as 14 dry sows or 18 baconers can be housed in such a pen, allowing 7 square feet floor space per sow, or 5½ square feet per baconer of approximately 200 lb. live weight.

Each pen should drain separately to a shallow outside drain. The drain should not run through a series of pens because this may cause an accumulation of insanitary material in the lower pens.

Feed troughs are not shown in Figs. 1 and 3. If desired troughs for water and food can be built-in along the walls of the feed yards. In the feed yard of the farrowing pen a special creep can be constructed so that the piglets can have free access to a self-feeder or an open feed trough, while the sow is excluded. Piglets can thus receive extra or special feed.

Such a creep consists of three guard rails, the lower one 10 inches from the floor, the middle one 8 inches higher and the top rail another 8 inches higher up.

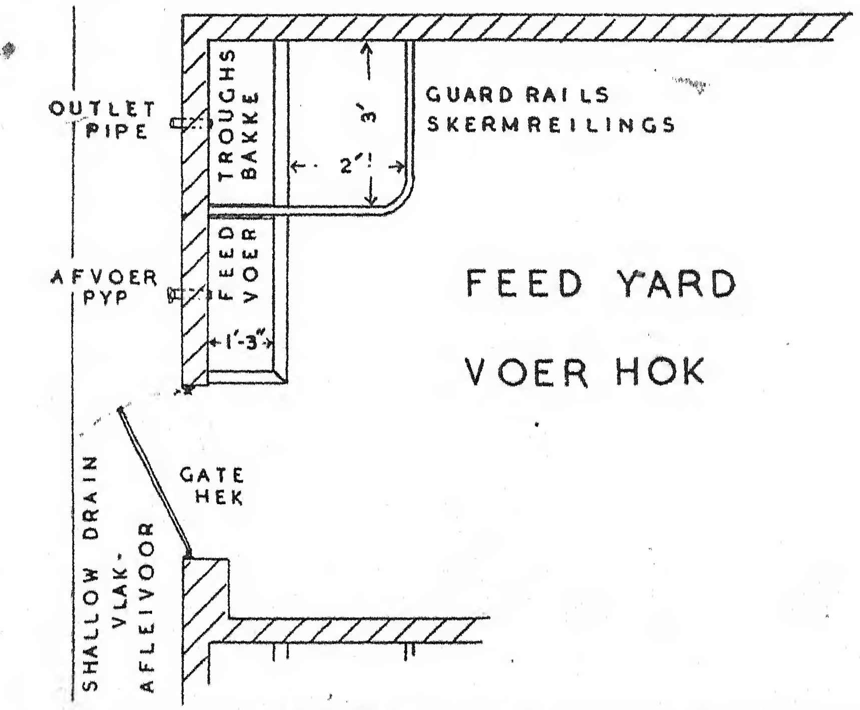


FIG. 4.—Plan of Creep and Built-in Feed Troughs in Feed Yard.

The Semi-intensive System.

The lay-out of a typical semi-intensive pigfarming proposition is shown in Fig. 5. This system is elastic and can be modified and used to suit the greatest variety of South African conditions.

ere again, a type of farrowing pen, as illustrated in Fig. 1 and 2, is dvised. Two such pens are built next each other under one roof saving building material. These farrowing pens a Fig. 5.

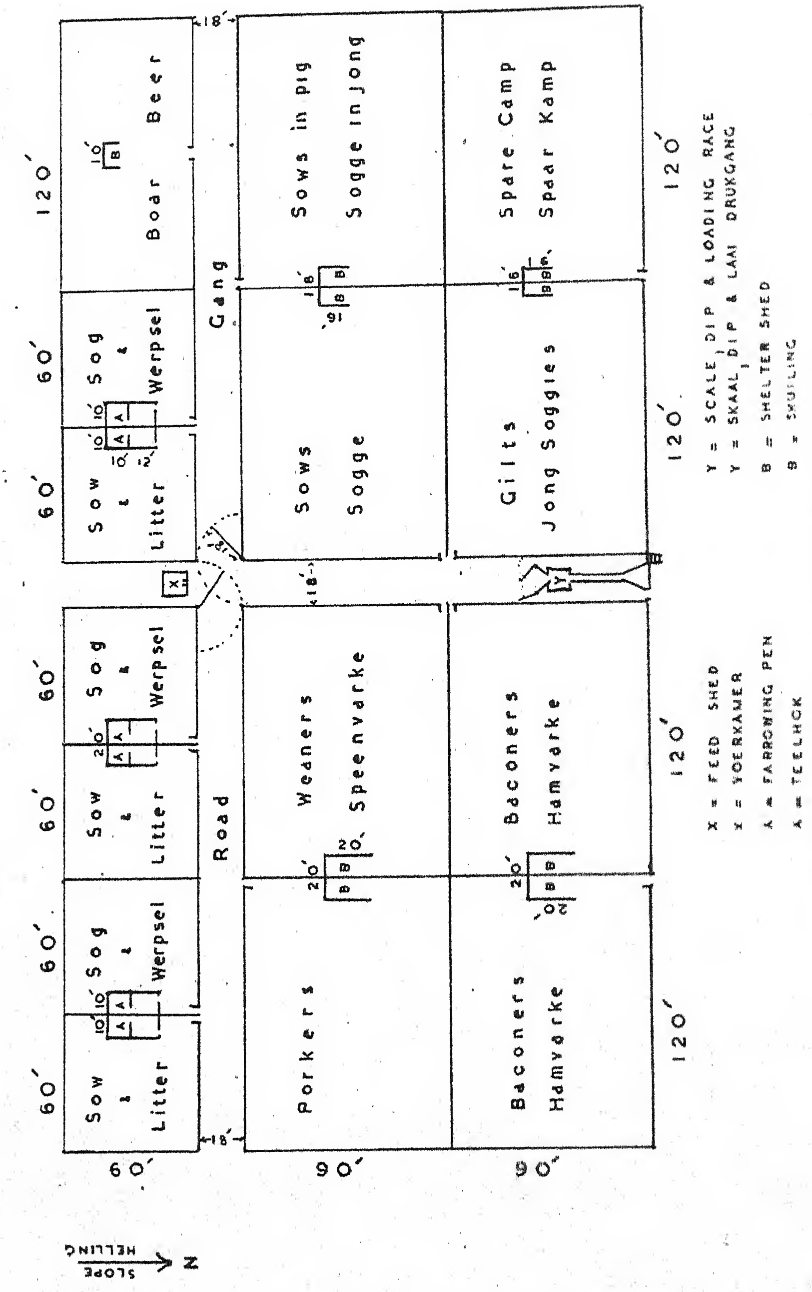


Fig. 5. Plan of Lay-out of a Semi-Intensive Piggery.

The shelters, marked B, can be fixed or portable. Fig. 6 illustrates a very useful type which can be constructed very cheaply where timber and thatching grass are plentiful.

Portable shelters can be made of wood, or of wood and iron. Portable houses made from wood and corrugated iron are shown in Fig. 7.

The number and size of grazing paddocks can be made to suit conditions. It is ideal to have sufficient paddocks so that they

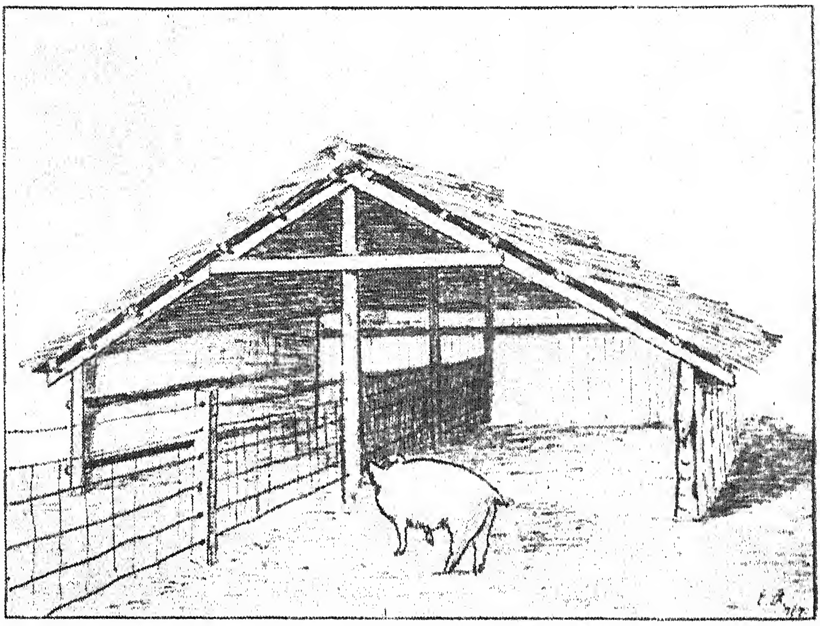


FIG. 6.—A useful type of Shelter.

can be rested, ploughed, sown and grazed rotationally. There is a practical limit to the number of pigs to run in one paddock, but there is no limit other than cost of fencing, to the size of paddock.

A farm with a series of paddocks as illustrated in Fig. 5, is preferable to a similar sized farm with a smaller number of larger paddocks.

The number of farrowing pens in relation to the size and number of other paddocks will depend mainly on the way farrowing is regulated. If all the sows are allowed to farrow in a bunch, then as many farrowing pens as sows are required. If, on the other hand, farrowing is arranged in such a way that sows farrow at intervals all the year round, then one farrowing pen can easily do for four sows per year.

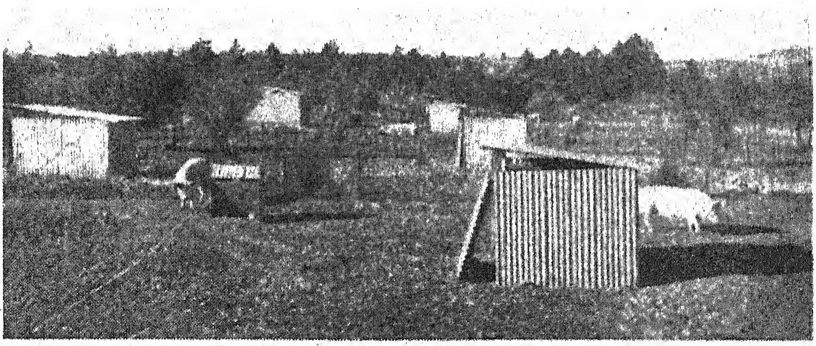
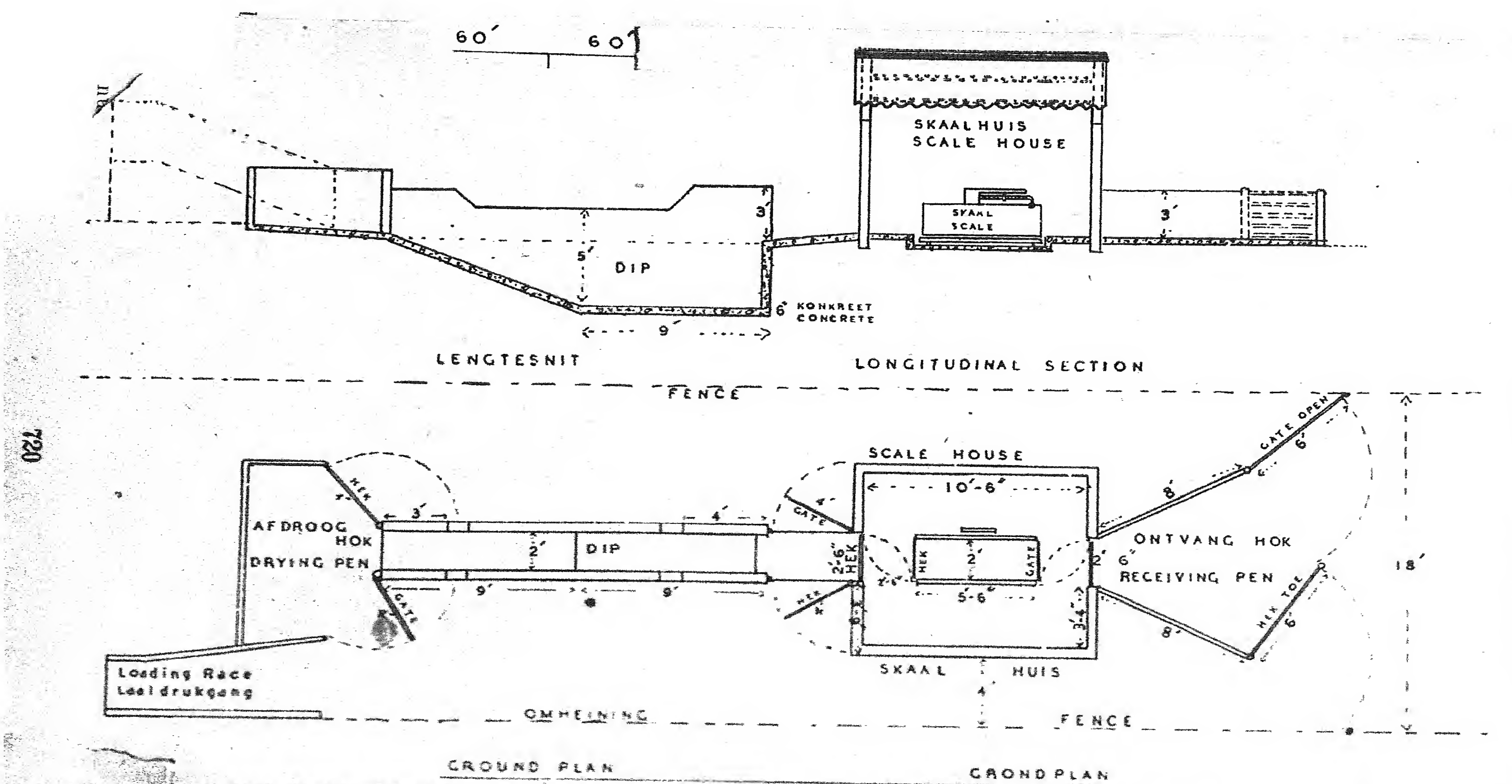


FIG. 7.—General view of a Semi-Intensive Pig farm, with permanen brick farrowing house in the background and portable corrugated iron hou in the fore-ground.



PIGS FORCING PEN, SCALE AND DIP. **DRUKHOK SKAAL EN DIP VIR VARKE.**

FIG. [illegible] The weighing box is a strong crate open [illegible] 5 ft. 6 inches long, 2 ft. wide (inside measurements) and 2 [illegible] high. It is made to stand on the platform of the scale. The scale [illegible] pit so that the platform is level with the floor. The 2 [illegible] gates of the crate swing [illegible] the 2 ft. [illegible] [illegible] towards the crate. Thus, when the crate gates and [illegible] doors are open [illegible]

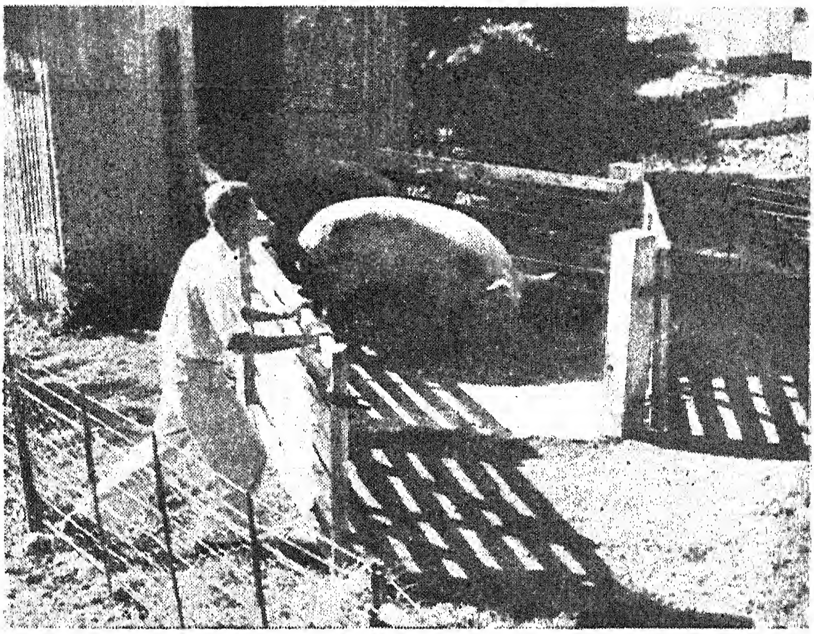


FIG. 9.—Pigs in forcing pen prior to entering the scale house.

With a lay-out as illustrated in Fig. 5 one could keep 24 sows if farrowing is regulated properly.

If sows are to farrow all the year round it will be advantageous to have two more spare camps so that the weaner, porker and baconer camps can be rotated.

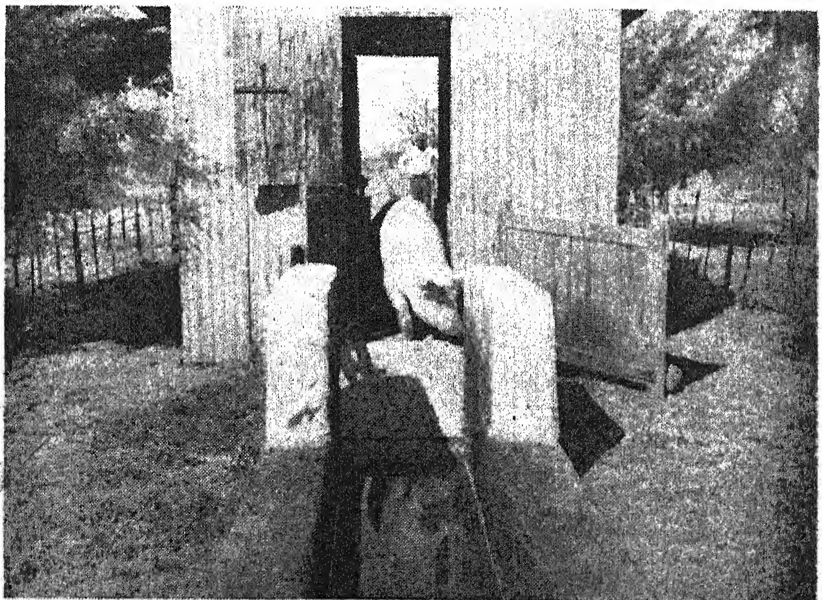


FIG. 10.—Pig emerging from scale house after being weighed.

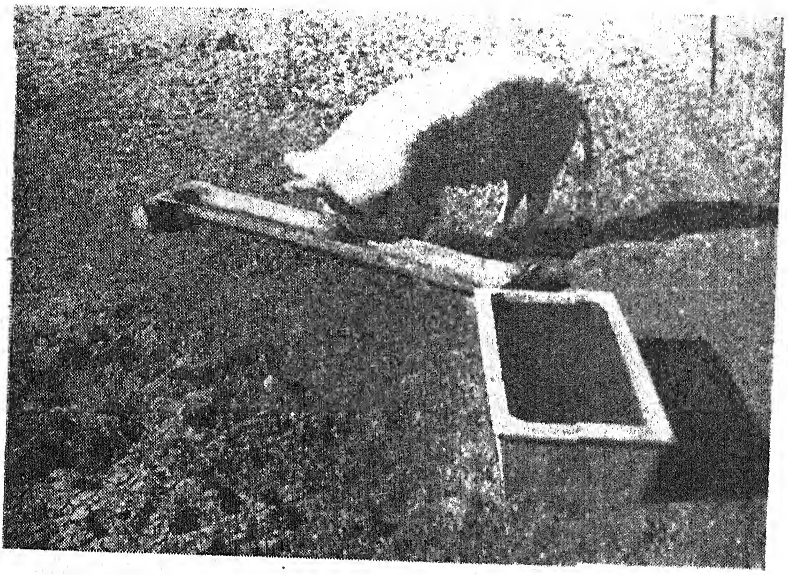


FIG. 11.—The water-trough is 18 inches wide, 9 inches deep and 3½ feet long (inside measurements).

Fleas are often troublesome in summer, and regular dipping must be resorted to. The 18 ft. swing gates, as illustrated in Fig. 5 facilitate the handling of the pigs with a minimum of labour.

Fig. 8 shows details of a forcing pen, scale house and scale, dip and loading race.

Note that in Figs. 8 and 10 there is a slope from the scale house to the water level of the dip. The fall should be at least 6 inches to prevent the splash from the dip flowing into the scale-house.

Similarly the floor of the drying pen should slope back towards the dip.

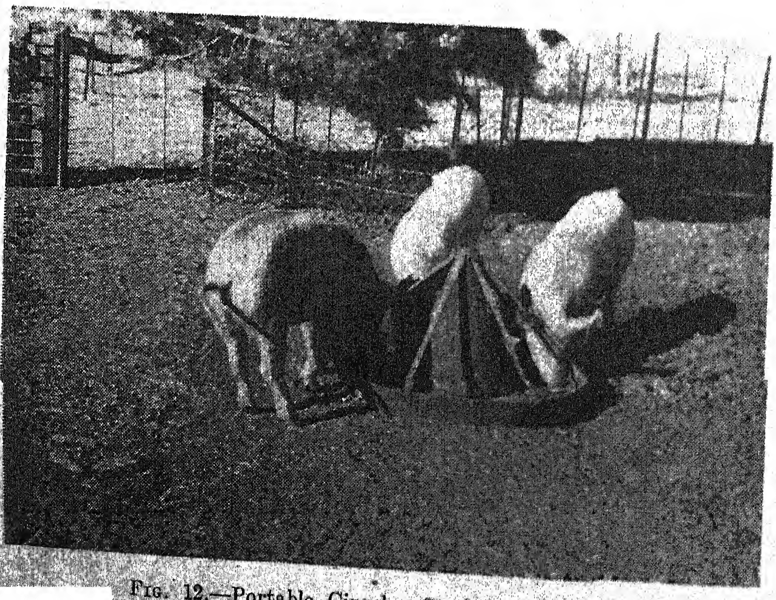


FIG. 12.—Portable Circular Steel Feed Trough.

Troughs.

Troughs can be fixed or portable. Portable feed and water troughs must be light enough to be handled by one or two labourers, but must be heavy enough and constructed in such a way that the pigs cannot upset or overturn them. In intensive houses troughs are generally built-in. Feed troughs should not be more than 6 inches deep. Water-troughs should be deeper.

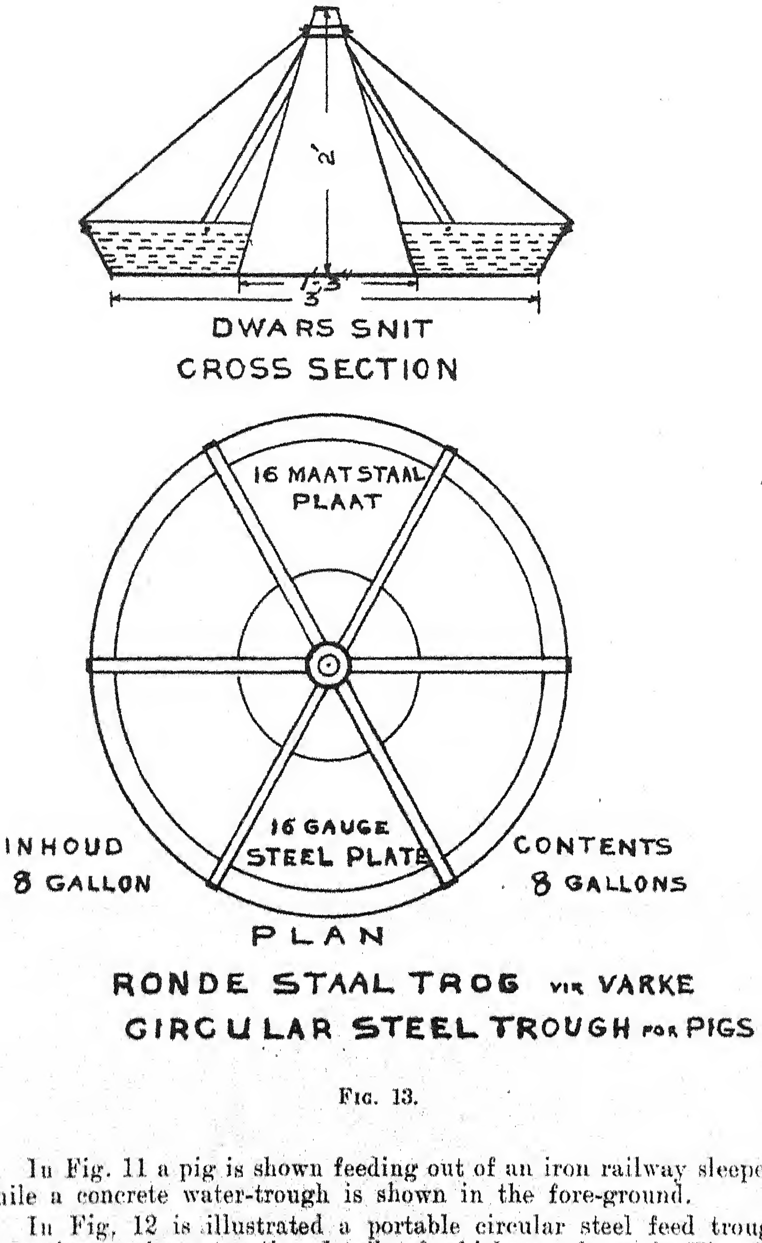


FIG. 13.

In Fig. 11 a pig is shown feeding out of an iron railway sleeper, while a concrete water-trough is shown in the fore-ground.

In Fig. 12 is illustrated a portable circular steel feed trough dimensions and construction details of which are shown in Fig. 13.

Where permanent feed or water-troughs are erected outside the pen and in a camp, precautions must be taken to prevent trampling

out of the soil around the troughs. It is advisable to have a space of about 5 ft. around the troughs, flagged out with stone grouted in cement.

Troughs can be made from various materials. For example, an old motor tyre cut in two along the circumference makes two useful feed troughs. Farmers do not lack in ingenuity, and the construction of suitable troughs from available material should not offer any difficulty.

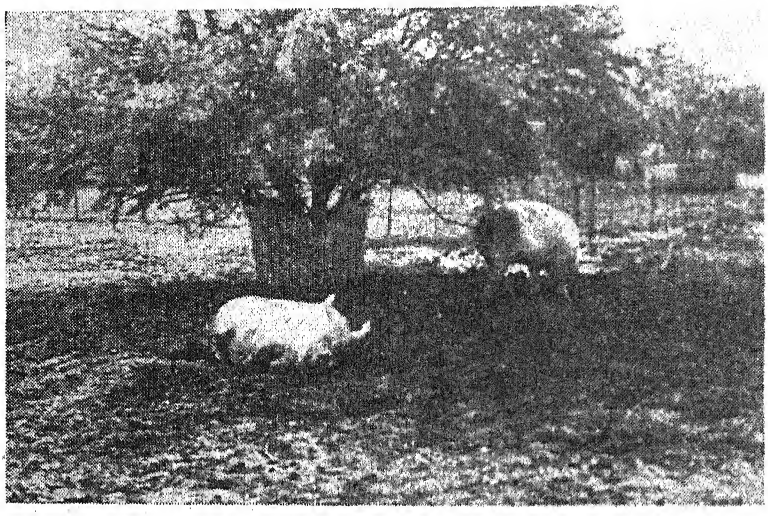


FIG. 14.—Tree protected by bits of corrugated iron.

Fencing.

A well constructed fence is the cheapest in the long run. Good quality pig netting, 2 ft. wide, is generally used. Barbed wire should be spanned 6 inches above the netting and also at ground level.

To prevent pigs from rooting under the fences, heavy stones or logs can be partially buried below and on the inside of the lower strand of barbed wire. Where large stones or logs are scarce, but material for making concrete is relatively cheap, a good plan would be to dig a trench 6 inches deep and 6 inches wide or a V-shaped trench 6 inches deep, and to fill the trench with concrete, reinforced with a strand of wire. The trench must be dug before the fence is erected. The concrete can be put in after the fencing posts have been placed in position. At regular intervals thick wire eyelets should be embedded in the concrete so that the concrete slab can be tied to the lower barbed wire strand.

Shade.

In hot areas, especially under the semi-intensive system, shade during summer is essential for the well-being of the pig.

Not only do trees afford shade, but they enhance the appearance of the farm. If a few trees are to be planted in each camp it would be best to plant them next to the fences. A willow or poplar tree near the water-trough serves the dual purpose of giving shade and of utilizing water when troughs are drained and cleaned.

To protect a tree, drive in three or four ordinary iron fencing standards to form a triangle or quadrangle around the tree. Just

[*Continued on page 729.*

Bush Encroachment in the Northern Transvaal.

L. O. F. Irvine, Officer in Charge, Pasture Research Station, Towoomba, Warmbaths.

BUSH encroachment is to-day the most serious pastoral problem confronting the stockfarmer of the northern Transvaal. Almost the entire sweet-veld area, approximately 11,500 square miles, and much of the mixed veld, approximately 23,600 square miles, is either already so densely bushed as to have exhibited a marked decrease in carrying capacity, or else is in the early stages of bush encroachment.

The assumption must not be made that bush encroachment is a problem of the northern Transvaal only. It menaces the bush country of the whole of South Africa to a greater or lesser degree. In fact, it is a problem of first class national importance and as such requires to be tackled firmly and without further delay.

It is surprising how few farmers are really alarmed at the situation. They know that the foliage and fruit of many of our indigenous bushes and trees are not only edible, but provide highly nutritious stock-feed, and argue that a densing up of the bush must therefore inevitably result in an increased carrying capacity of the veld, as a whole. Sound as this argument may appear to be, it does not hold good in practice.

Reduced Grass Growth.

Densing up of the bush invariably leads to a weakened grass-growth and, in the case of certain bushes, to complete denudation of the soil—so serious is the competition offered by the shallow root system of such bush: e.g., *Lekkerruikpeul* (Acacia benthamii), *Geelhaak* (Arctineus), and *Swarthaak* (Adetineus). The decrease in carrying capacity is also due in part to inefficient utilization of whatever grazing that does exist between and under the bush—consequent upon the relative impenetribility of such bush. Also, in part, to mechanical destruction of the veld by trampling, occasioned by the stock being obliged to follow certain fixed paths of travel.

The problem of bush encroachment has been under investigation on Government Pasture Research Stations in this country for the past seven years. Although, as yet, no economically, fully satisfactory general method of eradication has been discovered, much important information has come to light. In the course of this work it became apparent that the invasion of grassveld by bush—both thorny and non-thorny in type—is a phenomenon of the *present* century, particularly so during the last ten to twenty years. One of the most significant and alarming features is the fact that the number of bush seedlings annually becoming established is greater with each successive year. In short, *bush is invading grassveld at an ever increasing rate*. To quote a concrete instance: An 8,000 morgen property, situated in the Potgietersrust district, was devoid of thorn bush a mere 25 years ago, except in the extreme north-western corner where a few scattered bushes occurred. To-day the entire property is densely populated with thornbush: in fact *Lekkerruikpeul* has become so dense and strong over thousands of acres of chocolate turf as to completely inhibit the growth of grass.

The Cause of Bush Encroachment.

Discussions with old-timers and perusal of all the historical literature available, has revealed the fact that 100 years ago, the

bush country of the northern Transvaal comprised, almost exclusively, relatively open grassveld—the specific nature of both grass and bush, naturally varying with the climatic and edaphic environment. History shows further that veld-fires were not only as common in those days as in the early years of the present century, but that they were very fierce and swept over thousands of square miles of country before dying out, since there was almost nothing, other than the rivers, to stop them. It is also evident from the information available that in those early days the northern Transvaal carried fully as much animals—in the form of game and native stock—as it does to-day. Yet the veld was both vigorous and plentiful, but the bush was scattered. What is responsible for the colossal changes which have taken place?

The explanation appears to lie in an upset of the natural balance, consequent upon interference by man—mainly in the form of grazing-malpractice and comparative cessation of veld-burning.

Before the advent of the European—1836 onwards—the game and native stock used to graze the veld in the manner dictated by its natural characteristics—sourveld was used during the first half of the growing period; mixed veld during the latter part, and sweetveld during the dormant season only—that is, the seasons of the year during which each class, respectively, provided attractive grazing. Under this system of utilization, each class of veld was given sufficient rest during the growing period to maintain it in full vigour and was thus in a position to withstand the devitalising effect of almost annual burning off.

It was only later, in the early years of the present century, that the veld began to retrogress—the grass-sward became sparse and weak and, presently, invaded by young bush. Permanent settlement by Europeans, private ownership of land and the erection of fences, had led to departure from the above natural system of veld utilization and to the introduction of a year-long-scheme of management, whereby stock were kept on the same block of veld *throughout the year.*

The deduction drawn by investigators was the obvious one: depletion and devitalisation of the grass-sward had led to invasion by thorn and other bush; veld in this condition was considered to permit the establishment and unrestricted growth of bushseedlings, which, under normal conditions, could not have become established. Subsequent investigations, however, revealed the fact that although bush encroachment could usually be associated with veld-destruction, it was not always so: many instances were discovered of heavy infestation of otherwise intact and sound veld. In such cases it was found that the *bush seed had been transported thither* by one or other of the factors: manure, water or wind. It presently became apparent that any factor responsible for the deposition of viable bush-seed, was indirectly a major cause of bush encroachment. Thus veld-destruction was not responsible for, but rather due to the same causal factor as bush encroachment, viz., concentration of stock, leading through their partiality for the pods of most thorn bushes, to the deposition of much viable bush seed in their dung. (The germinating capacity of bush seed is, if anything, enhanced by its passage through the elimentary tract.)

The question which now naturally arises, is why then is bush-encroachment a phenomenon of the present century only. Surely the game and stock of the 19th century were as fond of Acacia and Dichrostachys pods as are our cattle of to-day? The answer is to

be found in the fact that there are infinitely more pods available to-day, as compared with then, and consequently there is to-day a vastly greater amount of bush seed being deposited by the above-mentioned factors. This increase in availability or supply of pods is in my opinion directly ascribable to the comparative cessation of veld burning, which has taken place.

Whereas in the 19th century, fierce veld fires used to sweep over any individual area of veld almost annually, to-day such areas may either enjoy complete protection from burning or else be virtually unburnable, as a result of veld denudation. Under the former conditions, not only was a certain percentage of the seed shed destroyed directly by fire, but likewise a small percentage of the past season's seedlings. In addition, almost all young and immature bushes in existence, were killed to ground level—only an occasional bush escaping and so serving to make good the natural decrease in the number of mature bush present. In this way, the balance between bush and grassveld was maintained.

Remove the influence or control exercised by more or less annual veld burning and what is the result? Not only does the destruction of seed and seedlings by fire cease to take place, but in addition all the bushes that were held in check are now allowed to grow more or less unhindered. The consequence is that within a matter of five or six years after the cessation of veld-burning, there are literally several hundred pod-bearing bushes present, where formerly there had been a mere half-dozen or so mature bushes.

Combating of Bush Encroachment.

There are two distinct phases to be considered in the combating of bush encroachment: (*a*) eradication or thinning out of bush; and (*b*) prevention of encroachment or re-encroachment.

Eradication or thinning out of bush.—Investigations to date have shown conclusively that bush cannot satisfactorily be *thinned out* by either veld burning or any conceivable scheme of grazing management. Once bush is firmly established, its eradication calls for special steps.

Thorn bush varies considerably in respect of nature of growth and tenacity to life: some are easily destroyed, others not. Certain species are shallow rooted, e.g., *Lekkerruikpeul* (A. benthamii), *Swarthaak* (A. detineus) and *Geelhaak* (A. vetineus) are easily eradicated by pulling or lifting out. Others, e.g., *Sekelbos* (Dichrostachys nutans) though easily pulled, possess the strange faculty of being able to produce stem growth from any injured root. Other types again are deep rooted, *Haak-en-steek* (A. litakupensis); or else fine stemmed *Fyndoring* (A. natolensis), and not amenable to pulling.

In terms of the results obtained to date, it would, however, appear as though the following is the most satisfactory procedure to follow in the eradication of the thorn bushes mentioned above—with the exception of Sekelbos, the destruction of which will be dealt with separately.

Large bush of the above species, excepting Sekelbos, are best destroyed by the application of paraffin to the bark for a distance about 1 inch above and 3 inches *below the junction of root and stem.* The soil which has to be scraped away to expose this point, should be replaced after treatment. (This method was first tested out by Scott and Pentz, in Natal, and gave over 90 per cent. killed. At

Warmbaths. an 80 per cent. kill was achieved and the cost of treatment worked out at an average of about 2s. 9d. per 100 bush killed.

Medium-sized bush are best destroyed by chopping off *just below the junction of root and stem*. Average cost of treatment amounts to 2s. per 100 bush killed. Mechanical means of destruction are under consideration and it is hoped to devise an implement which will simplify and reduce the cost of eradicating at least this class of bush.

Small bush are best dealt with by chopping out in the manner prescribed for "large bush". Cost of treatment approximately 1s. 8d. per 100 bush killed.

Sekelbos are best dealt with by scraping away the soil and sousing with paraffin, provided great care is taken to avoid severing any roots.

Prevention of Encroachment.

The investigations conducted to date indicate that if all existing young and immature bush are killed to the ground once every four or five years, complete control over bush encroachment will be achieved and a stable relation between bush and grassveld established. There appears to be two possible, practical methods: (*a*) controlled, periodic effective veld-burning, and (*b*) periodic artificial destruction of unwanted bush.

Effective veld-burning, in so far as the control of bush is concerned, calls for complete resting of the veld for a full year prior to burning. The burning ought to take place after the first good spring rain. The maintenance of veld vigour also demands lenient grazing of the veld during the ensuing growing period.

On this basis, the burning of veld once in five years, entails the sacrifice of approximately 25 per cent., whilst once in four years would mean a sacrifice of 30 per cent. of the *total possible* carrying capacity of a property. Thus, on a 35,000 morgen property, where bush is to be controlled by veld burning, some 7,000 morgen of veld would have to be burned each year, leaving only 28,000 morgen available for normal grazing and reserve. The property, at a stocking rate of 1:5 and 1/5th of the grazable area set aside as reserve, would thus only be able to carry 4,480 ox-equivalents instead of a possible 5,600. This means a difference of 1,120 ox-equivalents per annum or £11,200 (at £10 per ox-equivalent) or a cost of 6s. 5d. per morgen of the property per annum for bush control.

Artificial control, whether by native labour or by mechanical means, would mean an expenditure of say 1s. 9d. per 100 bush killed, at the present relative costs of eradication. If 1,500 bush have to be dealt with per morgen once in 5 years, it would mean an average expenditure of 5s. 3d. per morgen of the property per annum for the control of bush.

On this basis, the cost of bush control by the two methods is somewhat similar. On the other hand, one has to bear in mind the following facts:—

(1) The cost of artificial control will almost certainly be lower than that given, as a result of improvement in method as well as a probable smaller Union-population than indicated.

(2) The cost of burning will probably prove to be higher than indicated. For instance, burning introduces a high degree of instability, since burned veld is much more susceptible to drought than unburned veld. Furthermore, fire destroys valuable bush and grasses, as well as unwanted bush.

(3) A sacrifice in carrying capacity such as is indicated is not permissable where intensive farming is practised or where the full carrying capacity of the property is required.

(4) The divergence in relative costs of control by the two methods, is greater with veld of higher carrying capacity.

Under the circumstances, therefore, it is evident that in practice, *every effort should be made to control bush encroachment by artificial means.* It is recognized that the prevailing shortage of native labour renders it practically impossible to do so on very large properties. On the other hand, the introduction of suitable mechanized equipment would bring artificial control within easy reach of the average farmer. Should the purchase price of the equipment be rather too high for the average individual to bear, syndicates could be formed or alternatively wealthy individuals, companies or the Government could purchase the necessary machinery and hire it out to farmers on a basis similar to that upon which water-drilling machines are operated.

In conclusion, an appeal is made to every bushveld farmer to examine closely the situation on his farm: where bush is invading his grassveld, let him systematically and determinedly set about the task of combating this menace, thinning out the bush wherever necessary, elsewhere controlling it. Let him do this in the full knowledge that it is right and necessary in order to maintain the carrying capacity of his veld; that failure to pay heed to the menace of bush encroachment would surely and in a relatively short space of time. *force him or his children off the land* they have grown to love.

The Lay-Out of a Piggery:

[*Continued from page 724.*

below the surface of the ground place any old disused standards, heavy iron poles or concrete slabs and tie to the upright standards and to the pig netting and barbed wire fencing. This prevents the pigs from rooting underneath the protective fencing.

Isolation or Quarantine Pen.

It is strongly recommended that a separate isolation pen be erected some distance away from the piggery. Sick animals can be treated there. On arrival, animals purchased or obtained elsewhere, must always be placed under quarantine. They should be washed, dosed for worms and left in the isolation pens until there is reasonable certainty that they are clean and free from disease. Needless to say, drainage from such a pen must be away from the rest of the piggery. An isolation pen can be constructed similarly to the farrowing pen as illustrated in Fig. 1.

ACKNOWLEDGEMENT.

The writer wishes to express his thanks to Mr. M. J. D. Steyn, Engineer, Glen, for supplying the drawings of Fig. 1 and Fig. 13, and to Mr. C. H. Döhse, Soil Erosion Engineer, Glen, for his advice and co-operation.

Allotment of Government Guano.

It is hereby notified that only one allotment of guano will be made for the year 1944, commencing in April, but earlier if circumstances permit. The guano for disposal in this allotment is limited for distribution to *bona fide* farmers and gardeners within the Union who are to produce wheat, vegetables, onions and potatoes.

Applications for an allotment of guano must be submitted on the prescribed form as set out hereunder (the old form now being obsolete) and must reach the Superintendent, Government Guano Islands, Cape Town, before noon on 30 October 1943 after which date no application will be accepted in respect of this allotment; telegraphic applications will in no circumstances be accepted.

Completed application forms (incomplete forms will be returned for completion) must be signed before a Justice for the Peace or Commissioner of Oaths by the person requiring and entitled to the guano.

In submitting applications, applicants have to state the purpose for which guano is required and the area, in morgen, under cultivation. Applications must be submitted by registered owners or lessees actually carrying on farming operations; only one application will be accepted in respect of any one farm, or group of contiguous farms of the same owner or lessee.

Guano alloted will have to be taken up and paid for not later than 30 September 1944, after which date it will not be available.

The price of guano is £9 per toon of 2,000 lb. or 18s. per bag of 200 lb. net weight when packed, delivered in bags, free on rail, or on board ship, Table Bay Docks. The minimum quantity supplied is 200 lb. A subsidy of £1 per ton is allowed by the State, so that the actual price to the applicant is £8 per ton or 16s. per bag. Railage or freight is payable by the applicant to whom the guano is consigned, but railage must be prepaid when guano is consigned to a railway siding. In no case will guano be consigned or delivered to any person other than the applicant to whom an allotment has been made. Payment will not be accepted for guano until allotment has been made.

Enquiries in connection with the allotment of guano must be addressed to the Superintendent, Government Guano Islands, P. O. Box 251, Cape Town, from whom application forms are obtainable.

[*Specimen of Application form.*]

The Superintendent, Postal Address........................
Guano Islands Administration, Date.......................

Postal Address: P.O. Box 251, Cape Town.
Telegraphic Address: "Malagas", Cape Town.

I/We, the undersigned registered owner(s)/lessee(s) of the farm ....situate in the District of.......................................
(Block letters.)
....Province, hereby apply for an allotment of ....bags of guano for use during the year 194...... and declare that the guano allotted to me will be used solely for the purposes set out hereunder.

The extent of the farm is............................morgen; I intend working the following areas for the production of:—

(*a*) Wheat { Dry Land..............................morgen..............................
{ Irrigation.............................morgen..............................
(*b*) Vegetables...morgen..............................
(*c*) Onions..morgen..............................
(*d*) Potatoes..morgen..............................

I further declare that no other person, either as lessee or employee, is applying or will apply for guano for use on the aforesaid farm, and that the............................bags of guano now applied for will be used only on this farm.

The quantity allotted is required during the month of.....................
and is to be consigned to...
Name of Applicant..
(Block letters.)

....
Signature of Applicant.

The applicant is, to my knowledge, a bona fide agriculturist and knows and understands the contents of this affidavit.

Date.. ....
Place... Commissioner of Oaths.
Exempt from Stamp Duty.

Use Better Maize Seed.

J. J. du Toit, Field Husbandry Officer, College of Agriculture, Potchefstroom.

AT no time has the importance of maize as a food for human beings and animals been demonstrated more clearly than during the past season. In addition to such cultural practices as winter ploughing, the eradication of one or two weed crops before planting time, adequate spacing of plants, regular harrowing and cultivation, and the adoption of a system of rotational cropping, the use of pure and reliable seed which will go a long way towards increasing the yield per morgen. Under the prevailing conditions, when every morgen of land must produce the maximum yield, it is in the interest of every farmer that greater attention should be paid to the selection of sound seed. All ears showing the least sign of infection, immaturity and other defects which will result in poor germination and low yields must be eliminated. In order to ensure uniformity of seed size and to prevent crushing of the grains by the planter seed-plates it is advisable to grade the maize after its removal from the cobs by using a machine or suitable sieves. The seeds at the ends of the ears may also be removed by hand prior to shelling.

Farmers who are doubtful whether their seed is sound and viable, should send a representative sample to a college of agriculture, where it will be tested gratis for its germinating capacity.

Choice of Variety.

The problem of choosing a suitable variety of maize is admittedly not always a very easy task since there are various factors which affect their choice which may, for example, depend on the rainfall in a specific area and also on the time when the first regular rains arrive in spring. The usual planting season in the central maize-growing area is from October to November. If regular rains can be depended upon during this period, preference should be given to the medium late types. Generally speaking, it may be accepted that late varieties, which ripen within 130 or 150 days, will produce higher yields per morgen than earlier varieties, provided the distribution of the rains during the growing season is favourable. Should the first rains arrive late, however (i.e. in December or at the beginning of January), the choice will necessarily be limited to the more rapidly growing varieties which reach maturity in 100 to 120 days.

Apart from the rainfall, the choice of a suitable maize variety also depends on the purpose for which it is grown. For human consumption preference is given to white varieties, while yellow varieties are usually chosen for stock-feeding purposes owing to the carotin and higher vitamin content of the grain.

The farmer for his part prefers a variety which is resistant to drought, adapted to even fairly poor soil, and a good producer.

Taking everything into consideration, the following recommendation can be made in regard to suitable white and yellow varieties for the highveld and adjacent maize growing areas.

White Dent Varieties.

A large number of these are already in existence and new varieties are bred from time to time, while others, such as Iowa Silver Mine, Leguna, Ladysmith White, etc., are gradually disappearing from the scene. The following are the most popular

white dent varieties and their growing periods: Hickory King (150 days), Potchefstroom Pearl (150 days), improved Potchefstroom Pearl (135-140 days), Silver King (130-140 days), Early King (an Anveld type) (125-130 days), Anveld (125-130 days), improved Anveld (115-120 days) and Wisconsin (120 days). On the central highveld where the growing-season is relatively short, the Anveld types, also known as Early King, Durr, Engelsman, etc., appear to enjoy the greatest popularity. In the western Transvaal, on the other hand, the so-called Early King is favoured. When drought-resistant varieties are desired, preference should be given to non-suckering and non-stooling varieties and those which generally give only one large ear per plant. In this respect the improved Potchefstroom Pearl and the improved Anveld are two outstanding varieties. The latter may be strongly recommended for farmers desiring an early maturing and reasonably good yielder.

Yellow Varieties.

The outstanding yellow maize variety which is very strongly recommended for stock-feeding purposes in most parts of the maize belt is Sahara. Farmers with experience of this variety usually commend it, and experimental work carried out at the Summer Cereal Station at Kroonstad has also shown it to be an outstanding yellow variety with a high grain-yield capacity, even during dry years. The suitability of this variety lies in the fact that it is comparatively resistant to drought and gives high yields, even on relatively poor soils. The plants are vigorous growers and usually produce large ears with fat grains. In view of the high tonnage of plant material which can be obtained per morgen, this variety is also eminently suitable for ensiling.

Actually, there are several related Sahara types known by various names, e.g., Golden Beauty, Baker's Success, Natal Yellow Horsetooth, Kroonstad Ruby and ordinary Sahara. Some selections are also known by the names of the farmers who made the selection concerned or who crossed Sahara with other yellow varieties. Some of these strains differ in respect of thir growing periods. So for example, Golden Beauty, Baker's Success, Sahara and cognate selections usually mature within 140-150 days, Natal Yellow Horsetooth within 150-160 days, and Kroonstad Ruby within 135-140 days. The latter is an improved Sahara variety bred at the Kroonstad Experiment Station. The above-mentioned varieties and strains are classed as a grade 4 and since the prices for this grade have this year been fixed at the same level as those for grades 2 and 6, farmers would perhaps find it more advantageous to cultivate these varieties, since their yield capacity is as a rule higher than that of yellow varieties of grade 6 and even than that of some white varieties. It is generally also easier to get these dent types passed as a grade 4 than is the case with some white dent varieties, like Silver King, which frequently have to be placed in grade 3 instead of grade 2. In so far as the export trade is concerned, grade 4 maize was less popular in the past than grade 6, but having regard to the considerable expansion in our internal consumption, there is little reason why these yellow dent varieties will not be cultivated more generally for stock-feeding.

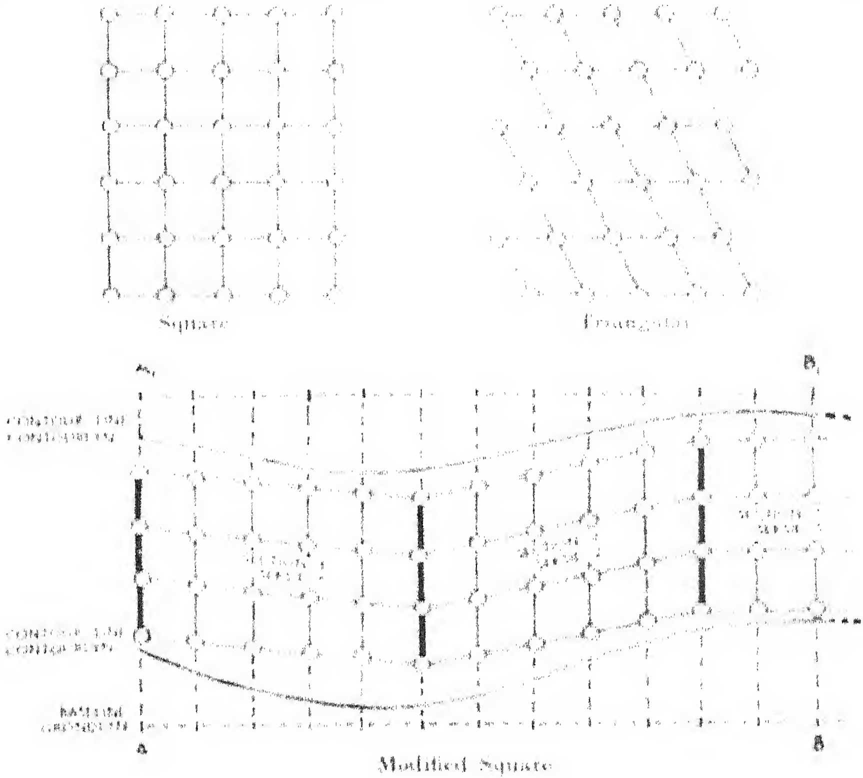
Nevertheless, next to the white dent varieties the yellow flint varieties are quite popular in most parts of the maize belt. The following are some well-known varieties and their growing periods: Boesman also known as Cincinnati (120 days); improved Boesman, also known as Hotnot (115-120 days); Natal 8-row (120 days);

 [Continued on page 742.

Contour Systems for Orchards.

J. C. le Roux, Professional Officer (Horticulture) and W. Unkles, Farm Manager, Sub-tropical Horticultural Research Station, Nelspruit.

IN articles and textbooks on horticulture the planting systems which invariably receive attention are the Square, the Triangular, the Hexagonal and other regular systems. These systems, though satisfactory for lands with even slopes, cannot be applied with success to irregular slopes, and, as the majority of slopes are not



Square

Triangular

Modified Square

FIG. 1.—Various Systems.

even, it is indeed surprising that the important question of contour layout of an orchard has received so little attention in the past.

Contour Planting.

The laying out of orchards on irregular slopes according to some or other regular system, as is so often done in practice, results in the trees being planted in straight rows which run approximately at right angles to the direction of the slope. Such an arrangement is unsatisfactory, as irrigation and stormwater run-off cannot be controlled, resulting in bad irrigation, soil erosion and the leaching out of fertilizer. With straight rows on uneven slopes it is usually found that storm- or irrigation water will flow in the desired direction for some distance and then suddenly change its course, forming deep dongas all the way down the orchard. Once this has taken place there is no option but to take irrigation water in the direction of the

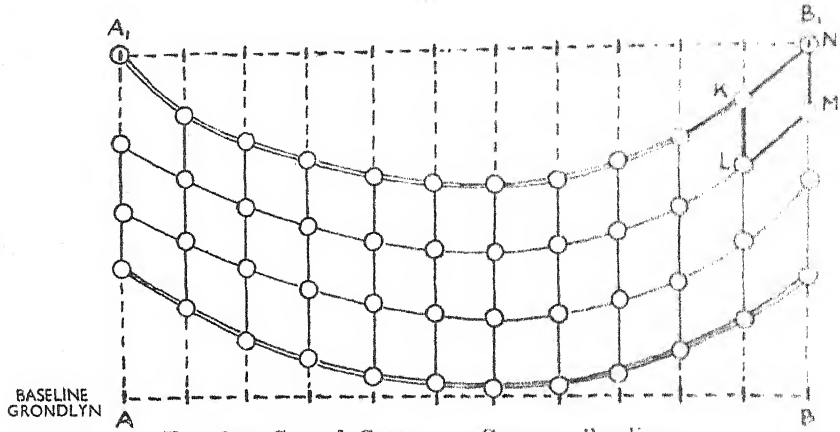


FIG. 2A.—Curved Contours. Common Baseline.

slope whereby further erosion will be caused. In high-rainfall areas the harmful effects brought about by these adverse factors are only too obvious. The difficulties can be overcome, however, by planting the trees along contour lines. In this connection contour lines are not used in the strict sense of the word, but have a slight fall in the direction in which the land is to be irrigated, or floodwater to be taken off.

In this article *rows of trees* will be referred to as running at right angles to the direction of the slope, and *lines of trees* as running parallel to the direction of the slope.

Instruments Required.

With regard to the layout of the orchard the idea should not be to decide beforehand on the system to be followed, but first to determine the actual lay of the land and then to plan the orchard accordingly. The main consideration should be to obtain an even fall of $\frac{1}{4}$ to 2 per cent. in the tree rows. The smaller this fall, the more accurately the laying out and levelling are to be done, as a small mistake may interfere with the movement of the water in the

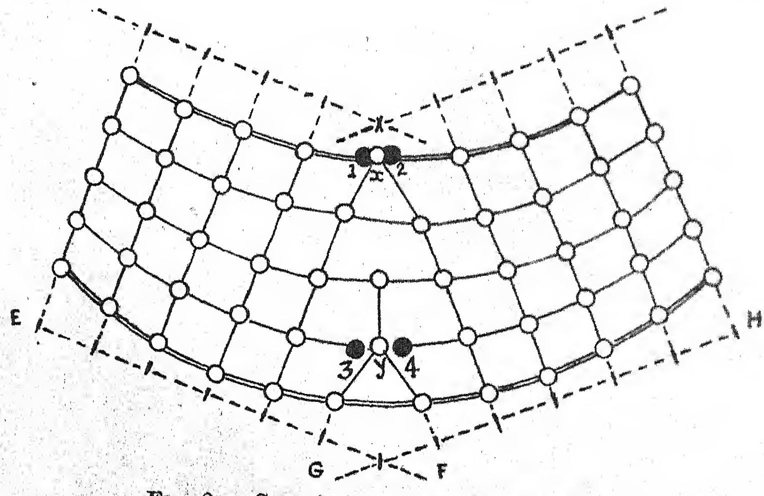


FIG. 2B.—Curved Contours. Two Baselines.

required direction. Examples of the instruments which could be used for his purpose are the Starrett, the Dumpy level, or home made instruments for obtaining levels. Other requirements are a staff, sighting rods, measuring chain and a large number of stakes. Spanish or other reeds would serve the purpose. In order to make the stakes more conspicuous, pieces of paper may be inserted into slits at the tops. After the land has been cleared and general levelling completed by means of suitable scrapers and land floats, preliminary soil levels may be taken, if necessary, in order to decide whether any of the regular systems could be adopted.

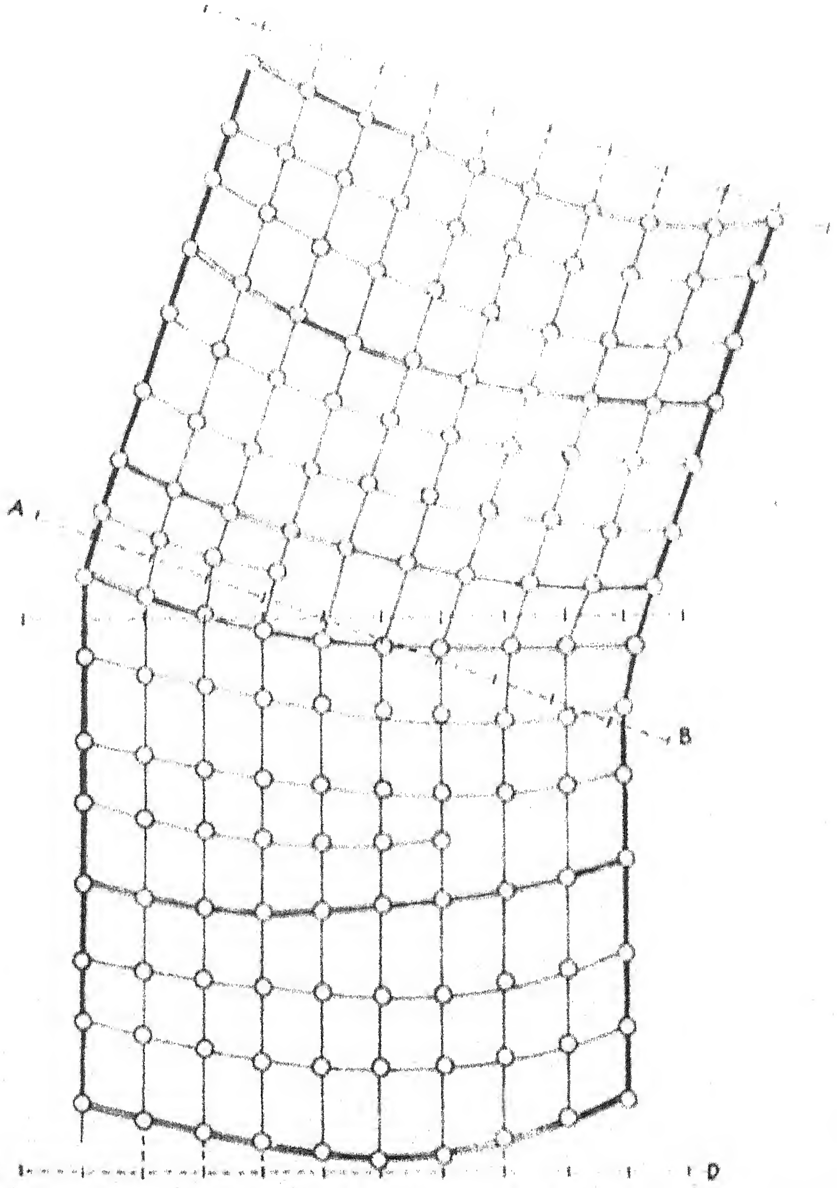


Fig. 26.—Curved Contours. Two Baselines.

The Lay-out on Regular Slopes.

If the contour of a land is such that a series of straight parallel lines with the desired fall ($\frac{1}{4}$ to 2 per cent.) can be drawn in any one direction, a regular system may be applied, e.g., the Square- or Triangular system (see Fig. 1, systems 1 and 2).

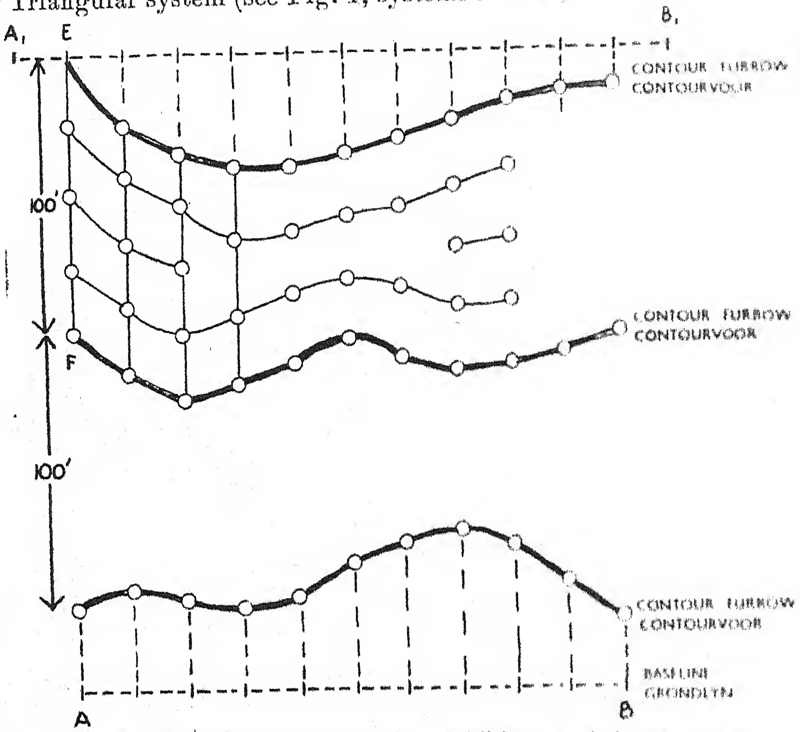


FIG. 3.—Diagram illustrating the establishment of the tree rows.

The Lay-out on Irregular Slopes.

Where the slope is irregular so that no regular system could be followed, a system of contouring in accordance with the lay of the land is established. The first requirement for this purpose is to draw a series of contour furrows about 100 feet apart (see heavy curved lines, Figs. 1, 2 and 3). These lines will now indicate the nature of the slope. If the direction of the slope changes gradually (see Fig. 1, system 3), the Modified Square system may be adopted. In this case the rows in the individual sections are straight, but slightly change their direction from section to section in order to keep the fall within the required limits. If the contour lines are somewhat more curved as shown in Fig. 2, system 4A, the tree rows follow the contour lines. For both these systems (3 and 4A) all lines of trees are straight and parallel and run at right angles to a baseline AB. This baseline (see Fig. 1, system 3 and Fig. 2, system 4A) is at right angles to the direction of the greatest fall of the orchard. A_1B_1 in these figures is a line which runs parallel to the baseline AB and is used to facilitate sighting.

In that part of the land where the contour lines run more or less parallel to the baseline, the trees are placed rectangularly, but where the contour lines curve away, the areas between the trees form parallelograms (see KLMN in Fig. 2, system 4A). When these parallelograms become too flat, more than one baseline is used, each

forming right angles with the direction of the greatest fall of the particular section. This gives rise to the layout illustrated in Fig 2, system 4B, with EF and GH the two baselines. The position of the trees in the central triangular area are staked out to the best advantage, i.e., tree X replaces trees 1 and 2, and tree Y replaces trees 3 and 4.

Fig. 2, system 4c, illustrates the orchard layout on a land where the contour lines of the top section is considerably different from that of the lower section. The top and lower section have their own baselines (AB and CD in the figure) running at right angles

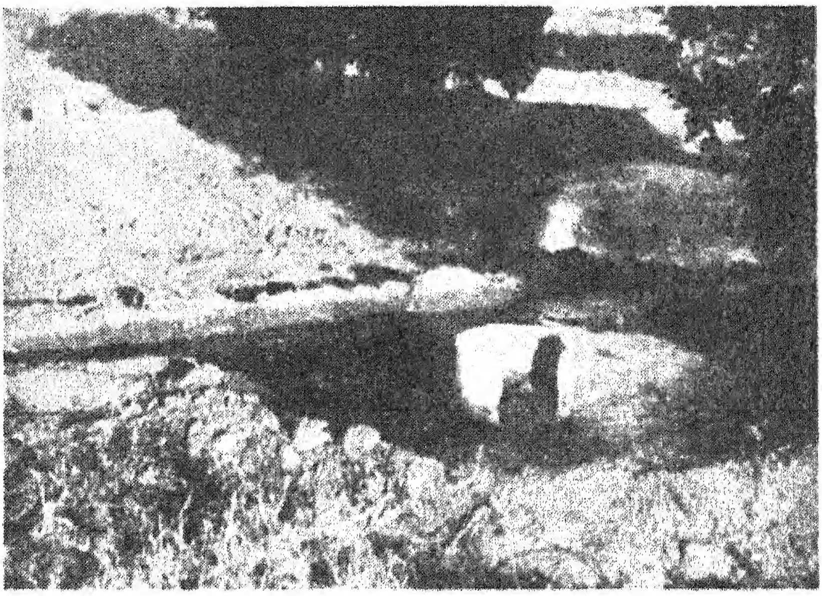


Fig. 4a.—The dual purpose pipe.

to the direction of the greatest fall. In the area between the two sections the tree lines meet at an angle forming an elbow.

The Spacing of the Tree Rows.

With proper contouring on uneven land the distances between the tree rows vary. Should the average distance be 25 feet, the maximum and minimum distances would be about 28 and 22 feet respectively. Contour furrows as described above are used in establishing the tree rows. A suitable baseline AB and sighting line A_1B_1 (see Fig. 3) are staked out. The tree positions on the contour furrows are next staked out by sighting between opposite points on the lines AB and A_1B_1. In the areas between the contour furrows tree positions are systematically established by measurement, simple calculation and sighting. A surveyor's chain is laid down fairly straight between the tree positions E and F in Fig. 3, and the measurements taken. If this is 100 feet it will be seen that three tree positions 25 feet apart are staked at the 25, 50 and 75 feet points. After the approximate positions of these stakes have been determined, the stakes are lined up perfectly by sighting between the tree positions E and F. In a similar manner the number of trees and the distance they are to be apart are determined for each line.

Where, in the second and third lines from the left, the total measurements happen to be 90 feet there will be three trees all 22½ feet apart. For the fourth line, where the total measurement is 81 feet, it will be found that there will be two trees 27 feet apart, as three trees in addition to those on the two contour furrows, will give a distance below the 22 feet range. In this manner the staking of all tree positions is completed. It will be noted that some rows come to an end while in other places additional rows are to be fitted

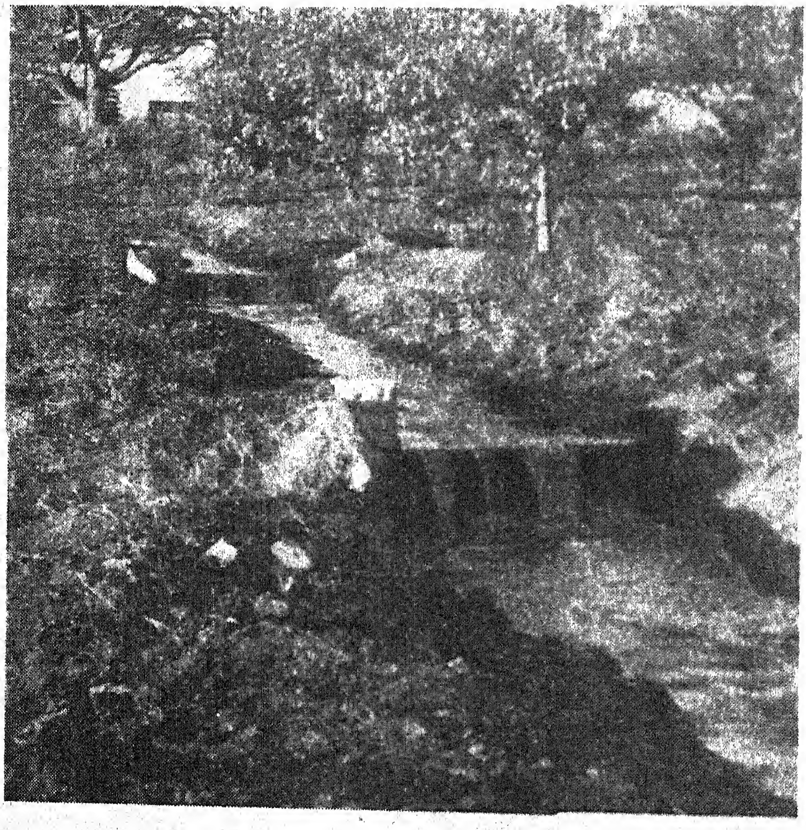


FIG. 48.—The Stepped Furrow.

in. The incomplete and additional rows, and irregularity in spacing will complicate cultural practices to some extent. However, this difficulty is outweighed by the advantages of the contour layout.

Irrigation Supply and Stormwater Removal.

In laying out orchards on the contour system, adequate provision should be made for supplying irrigation water to the heads of the contour furrows in each section. For this the standard system of underground pipelines with standpipes for delivering water to the heads of rows is recommended. Where the pipeline system is not possible, either grasslined or stepped furrows could be used to prevent erosion.

Provision should also be made for the removal of stormwater at regular intervals without erosion being caused. Where underground pipelines or stepped supply furrows are used, these could be so

[Continued on page 746.

The Wool Clip at the Coast.

J. C. de Klerk, Sheep and Wool Officer, College of Agriculture, Glen.

THE 1942-43 wool season is almost past and many farmers will undoubtedly be highly satisfied with the prices realized by their wool, viz., 18d., 20d., 24d., and even 26d. per lb. These farmers therefore received an average of £18 to £20 and more per bale, or 15d. to 18d. per lb.

On the other hand, there are also farmers whose best lines fetched only 11d. to 13d. per lb. so that their average was about 10d. per lb. It is particularly the latter farmers whose attention is drawn to the following points:—

Quality is a cardinal requirement in wool. The farmer should not blame the wool market, the broker or the classing if he gets less for his wool than he expected, but should first find out whether he himself is not at fault. A farmer who can produce light, sound wool of good length, uniform fineness and well-defined crimp, with softness and fullness of handle and an attractive appearance will obtain a very good price to-day.

Factors which exercise a very adverse effect on the quality of wool, are parasites (external and internal) and incorrect feeding, especially in cases where animals graze on bare, trampled veld throughout the winter, or are kept on dusty lands which make the wool feel heavy and dry.

Classing of Spinners' Wool.

It should be the aim of every farmer to-day, to produce a spinners' wool which is possible only with good breeding, feeding and treatment and then to class his wool correctly. In addition, he should set his standard in the spinners' class as high as possible. If he can, for example, produce a type 6 (usually 70's, 2¾ in. and longer) instead of a type 11 (also usually 70's, but only 2¼ in. long), this means a profit of 1½d. per lb. on a wool with a 50 per cent scoured yield. If, on the other hand, the wool does not conform to the standard necessary for the spinners' class and is appraised as good combings (class 105), the grower loses 2d. per lb. on the same wool. Good classing is therefore essential if wool of the desired quality is to qualify for the spinners' class and depends upon the following:—

Fleeces.—Every fleece must be thoroughly skirted, and the hairy neck folds and backs removed. Each fleece should then be tested for tensile strength, after which all sound fleeces of more or less the same length (the difference should not be more than ¼ inch) and with the same fineness should be classed together. Fleeces which are considerably shorter, should be placed in a second line. If the average wool is medium-fine, all fleeces which vary from this or which are appreciably stronger, should be baled separately. The main considerations should be: uniformity of length, spinning count, colour, scoured yield and quality.

Backs.—Keep all backs separate and mark BKS, but do not fall into the error, which is so common to-day of mixing these with bellies. Such wool is sold as inferior combings and must be re-packed in order to remove the bellies. Good bellies are worth considerably

more than inferior, dirty backs, the first class being a speciality wool for which there is a keen demand.

Tender Wool.—Keep all tender wool separate and mark it T.D.R. In no circumstances must such wool be included with sound fleeces, since (like backs) this immediately brings the fleece lines down from spinners' wool to good combing, and so causes a corresponding loss. If, therefore, there is not sufficient of this type of wool to fill a bale, it should be included with the combings if light, or with the backs, if dirty.

Odd Line.—Separate all fleeces which are off in colour, and quality and which are too heavy for the top lines and mark them O.D.D. This line therefore includes all fleeces which do not qualify for the better lines.

N.B.—These fleeces are inferior in every respect, and must therefore have come from inferior sheep. Consequently in order to effect an annual improvement in the quality of the flock and wool, ewes should be classed before shearing time. All ewes whose wool is too short for a twelve month's growth and those which produce too little and/or ropy wool, which is of poor quality and off-coloured or wool with an excess of yolk, must be marked and culled, so that breeding with them may be discontinued. Good rams should be used with the best ewes only since this is the only way in which the yield of wool per sheep can be placed on an economic level and the income per lb. of wool increased. In order to indicate how the incomes from wool may differ, the average incomes per lb. of wool of three farmers in a certain district are given below too:—

Mr. A—an average of 12½d. per lb. (14 bales).

Mr. B—an average of 13½d. per lb. (20 bales).

Mr. C—an average of 13¾d. per lb. (10 bales).

Crutchings.—Large quantities of crutchings are to-day being sent to the coast with lox and all. The inclusion of lox in any clean wool is an infringement of the packing regulations, and not only is there the danger that such wool will fetch very poor prices, but there also is the further risk that it may be withheld from the market for re-sorting at a cost of 10s. per bale. It is therefore essential to remove all lox and to mark the remainder BP or CBP, according to the length.

Lamb Wool.—Large quantities of lambs' wool are also sent to the coast without any attempt having been made to clean the wool, or to remove the lox. There is always a keen demand for lambs' wool which has a delightfully attractive and soft texture and is eminently suitable for soft warm underwear. The trouble involved in clean sorting will be richly rewarded. Lift lambs' wool from the floor with two flat boards hanged at one end with a strip of canvas or leather, and clean it thoroughly on a smooth table or a sorting table covered with a cloth. Care should be exercised not to include dung or dags.

Coarse and Coloured Wool must not be baled together with Merino wool. The kemp and coloured fibres may totally ruin valuable Merino wool, combings, yarn or manufactured articles of clothing and it is for this reason that the practice is so undesirable. Coarse and coloured wool should rather be sent to the coast in grain-bags, but if such wool is packed in the same bale as Merino wool a layer of stout paper should be placed between the two to prevent kemp fibres wool from falling into the Merino wool.

Advantage of Wool Classing.

That it pays to class wool is beyond all doubt, but the following examples should be of interest:

Particular note should be taken of the original appraisal of the wool as regards, type yield and price on its arrival at the coast and the subsequent appraisal after the wool had been reclassed by the broker.

Mr. X.

Initial Appraisal.						Subsequent Appraisal.				
No. of Bales.	Average Weight in lb.	Description.	Type.	Yield.	Price per lb.	No. of Bales.	Average Weight in lb.	Type.	Yield.	Price per lb.
6	319	B.M.	88	42	12d.	6	291	51	47	14⅜d.
1	222	B.M.	88	42	11¾d.	1	204	51	47	14¾d.
1	222	CBP	134	36	7½d.	1	288	113	38	9½d.

Lox sold for 5½d.

N.B.—The fleece lines were in the first instance so poorly skirted that they were appraised as inferior combings and there was so much lox present in the bellies line, that it was valued as lox. After re-sorting, the fleece lines jumped to good combings with a 5 per cent. higher clean yield. After the lox had been removed from the bellies, the CBP was sold as a 10–12 months' bellies line.

Initial appraisal: £113. 12s. 5d. Actual income: £132. 1s. 4d. Gain on the eight bales: £18. 8s. 11d.

Mr. Z.

Initial Appraisal.						Subsequent Appraisal.				
No. of Bales.	Average Weight in lb.	Description.	Type.	Yield.	Price per lb.	No. of Bales.	Average Weight in lb.	Type.	Yield.	Price per lb.
2	300	A.M	94	44	10⅝d.	2	455	57	45	12¾d.
1	330	B.M	94	40	10⅝d.	1	284	62	44	12½d.
1	301	E.M	97	44	10⅝d.	1	255	62	45	11⅝d.
1	407	C.M	97	36	8½d.	1	345	91	40	10¾d.
1	298	L.	97	42	10⅝d.	1	243	130	46	10⅛d.
1	356	L.	40	40	9⅜d.	1	253	130	46	10¾d.

N.B.—All the fleece lines, including lamb's wool, were in the first instance appraised as inferior combings. After re-sorting, all the lines except the C.M. which was placed in a higher class, were classed as good combings with a considerable increase in scoured yield, while the lamb's wool then fell in the lamb class.

Initial appraisal: £97. 11s. 7d. Actual Income: £112. 7s. 7d. Gain: £14. 16s. 0d., *i.e.* over £2 per bale.

Mr. A.

Mr. A's bellies lines were so full of lox that they had to be withheld from the market for the lox to be removed:—

Initial Appraisal.						Subsequent Appraisal.				
No. of Bales.	Average Weight in lb.	Description.	Type.	Yield.	Price per lb.	No. of Bales.	Average Weight in lb.	Type.	Yield.	Price per lb.
9	358	C B P	134	38	8¼d.	7	352	113	46	12d.
1	426	B P	134	38	8¼d.	2	561	134	37	7½d.

N.B.—All the bellies were in the first instance appraised as lox. Two bales of lox were actually removed and the remaining seven bales sold as good bellies.

Initial appraisal: £123. 10s. 0d. Actual Income: £159. 19s. 4d. Gain: £36. 9s. 4d.

The expenses involved in re-sorting, however, amounts to £5 (10s. per bale). Mr. A therefore suffered a dead loss of £5 which was totally unnecessary and which could have been avoided if he had done the work properly in the first instance.

The following table reflects the prices offered for wool in the condition in which it was originally placed on the market. Owing to the excessive quantity of lox present, it was withheld and re-sorted, and the prices subsequently realized are also indicated below:

(For every bale, 10s. is again deducted, which constitutes a dead loss to the producer.)

INITIAL APPRAISAL.						SUBSEQUENT APPRAISAL.					
No. of Bales.	Average Weight.	Description.	Type.	Yield.	Price per lb.	No. of Bales.	Average Weight.	Type.	Yield.	Price per lb.	Gain per lb.
1	383	C B P	134	40	8½d.	1	311	91	42	10¾d.	2¼d.
6	319	Fleeces	88	42	12d.	6	291	51	47	14½d.	2½d.
1	222	„	88	42	12d.	1	204	51	47	14½d.	2½d.
1	222	B P	134	36	7¾d.	1	288	113	38	9¾d.	2d.
1	291	„	134	39	8¼d.	1	262	113	43	11d.	2¾d.
2	351	„	134	36	7¾d.	2	293	91	41	10¾d.	3d.
3	381	„	134	39	8¼d.	3	323	113	47	12¼d.	4d.
1	312	„	134	38	8¼d.	1	275	91	43	10¾d.	2½d.

Attend Wool-Classing Demonstrations.

By regularly attending wool or wool-classing demonstrations for a few years, wool-growers can greatly increase their knowledge of wool and its processing.

Below are the results obtained in several districts in which farmers, who attended wool-classing demonstrations during the past two years, systematically prepared their clips for the market as thoroughly as possible, with great advantage to themselves.

Season.	*Spinners' Wool.*	*Good Combings.*	*Inferior Combings.*
1940–41	38%	59%	3
1941–42	50%	50%	—
1942–43	57·75%	40·48%	1·77%

Use Better Maize Seed:—

[*Continued from page 732.*

Eksteen (130 days) and Peruvian (110-115 days). As can be deduced from their growing periods, these varieties are early maturing and may still be planted comparatively late in the season. Furthermore, they are also suitable varieties for poultry feed in cases where it is necessary to feed the grain whole.

ERRATA.

On page 703 of "*Farming in South Africa*", September 1943, under Chemical Composition of Compost (2nd column in table) substitute 0·23 for 2·03.

In the 3rd column the weight of phosphate in lb. is per 10 *ton* of dry compost and not per *ton*.

Prickly-Pear Eradication by Insects and Felling of Plants.

Dr. F. W. Pettey, Officer-in-Charge, Biological Control of Prickly Pear.

ALTHOUGH *Cactoblastis cactorum*, since it was first liberated in the veld in 1933 has effected considerable damage to prickly pear, *Opuntia megacantha* by destroying much of the succulent growth, by reducing its fruiting capacity, thus greatly retarding its spread, and by completely destroying many young scattered seedlings as they have appeared, it has nevertheless failed to attain the full

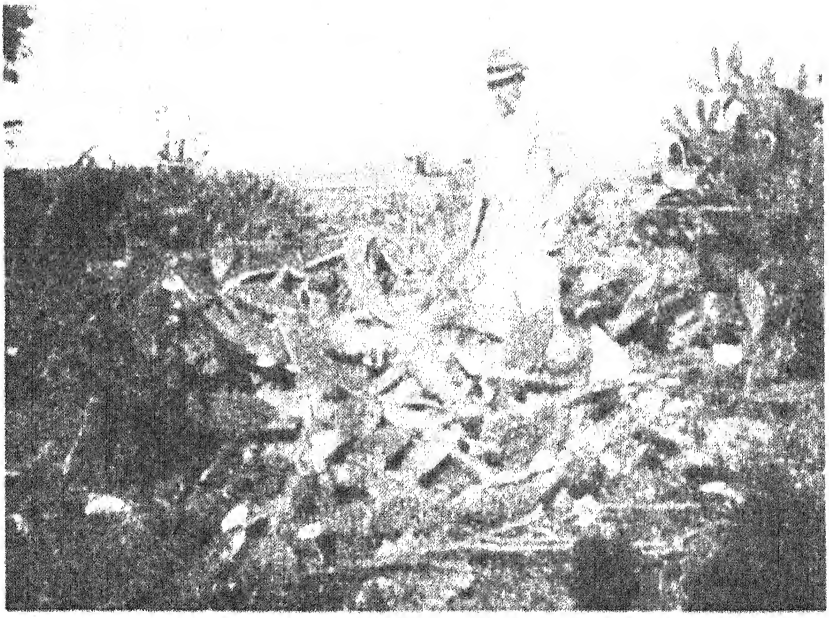


FIG. 1.—Prickly pear immediately after it was cut down in June 1940 and infested with the cochineal, *Dactylopius opuntiae*.

purpose desired, mainly because it cannot thrive in the woody parts of its host plant. In considerable portions of the eastern Cape Province flesh-eating ants have prevented this insect from making any progress at all. Other factors which have hindered its progress are the mucilaginous nature of the sap of the pear plant in which a considerable percentage of the young larvae die, extreme heat in summer which kills many mature larvae as they crawl on the bare ground to seek shelter for spinning their cocoons, parasites which infest and attack many insects in their immature stages, baboons and monkeys which devour the larvae, and rodents which eat the cocoons.

The New Cochineal.

When it was proved that *Cactoblastis* would be only partially successful in the destruction of this plant, a small consignment of the cochineal *Dactylopius opuntiae* was imported from Australia in 1937, after it was determined there that this insect would thrive on this

species of *Opuntia*. The cochineal was liberated in the veld that year, and in 1939 there was sufficient material to start general distribution of the insect on pear infested properties. A staff of approximately 30 men, with nine lorries, has been engaged in this work since the beginning of 1940. Throughout the eastern Cape Province, where prickly pear exists, pear segments infested with the insect have been distributed at intervals of about 200 yards in all reasonably accessible pear and at intervals of about 30 yards along all roadsides and lower slopes of mountain sides. This work is now nearly complete and the cochineal has spread rapidly in these areas and has infested practically all the pear plants.

The new cochineal has proved to be much more toxic to the prickly pear than the old cochineal, *Dactylopius coccus*, and already it has accomplished a high degree of injury to the plants over vast areas, particularly in sections distant 30 miles or more from the coast, by defoliating them, destroying the fruit before it reaches maturity, completely killing many small plants and some large ones. But the cochineal, as well as *Cactoblastis*, has its limitations. It does not completely kill the majority of the large plants, although it may greatly reduce the density of the foliage. It has acquired two serious natural enemies, viz., the lady bird beetles, *Cryptolaemus montrouzieri*, and *Exochomus flavipes*, which are now present in all areas of the Cape Province, and seriously retard the increase of the cochineal insects by feeding particularly on the larvae. The cochineal is consequently greatly reduced in numbers, especially in the spring and early summer, but thus far in most of the non-coastal areas the cochineal insects breed and increase sufficiently rapidly in the summer and early autumn so as greatly to out-number their beetle enemies and to continue their injury to the pear plants. However, even in those areas where they are the least handicapped by the depredations caused by the beetles, they cannot completely eradicate the standing or growing prickly pear plants.

Felling of Prickly Pear Plants.

It has been found by extensive tests that the cutting down of prickly pear infested with the cochineal will result in its almost complete eradication by the cochineal twelve to eighteen months afterwards. Pear plants considerably defoliated either by *Cactoblastis* or by cochineal are in a weak condition and the great majority of them in this state succumb completely to the shock of cutting. If plants are cut off close to the ground, any regrowth that may appear from the roots or underground main stems, will generally be weak and it will soon be completely destroyed by one or the other insect. Some regrowth occurs from the felled branches, but the cochineal on the undersides of the succulent leaf pads which appear, soon increases sufficiently to kill this regrowth, as few beetles infest such cochineal. If stumps are left above the ground surface, strong regrowth may result which the insects may be unable to destroy.

Property owners are therefore urged to assist these insects by cutting down the prickly pear as soon as it is generally infested with the new cochineal. There is no other satisfactory and economical means of completely clearing the veld of this plant. It is unnecessary and undesirable to pile the cut-off pear branches in heaps. Piling only adds to the expense and results in killing many insects before they have served their purpose.

The felling of prickly pear is an urgent necessity if this pest is to be eradicated. The labour cost of cutting down the plants varies

from about two shillings to a pound per morgen, the amount depending on the abundance of pear plants, the size of the plants, the density of the clumps of plants, the density of the foliage, presence or absence of bush mixed with the pear, and the degree of destruction of the plants by the insects. The average cost of felling is five shillings per morgen in the Karroo and ten shillings per morgen in non-Karroo inland areas. Pear which has been so damaged by cochineal or *Cactoblastis* that few succulent segments or branches are left, is much more easily and cheaply felled than those dense in foliage.

FIG. 2.—The same prickly pear in July 1941, one year after it was cut down. (Note that the pear is now completely killed. There is no regrowth.

With a view to economy it is necessary to fell the pear when it is in this condition. Delay will almost certainly result in such plants acquiring new foliage and becoming dense again. Furthermore, which is an important consideration, and a serious matter that should not be ignored, there is a possibility and even probability, that in due course, the cochineal in the future may become less toxic than the present generations of the insects. The most toxic insects that infest the leaf pads cause the segments to fall to the ground causing the insects to die, while the less toxic insects do not kill the leaf pads which they infest and these survive to increase and multiply a less toxic strain. For these reasons farmers and divisional councils, municipalities and other property owners concerned are strongly urged to make the most of the opportunity which is now presented to clear their lands of prickly pear by cutting down the plants thoroughly and properly. Such an opportunity may soon be lost and may never occur again. The general public has incurred considerable expense in the work of massed production, distribution, and spreading of the insect enemies of prickly pear throughout the pear-infested areas. The property owners concerned should now do their part in assisting these insects and incidentally themselves by felling their prickly pear. It is absolutely necessary to cut down the prickly pear plants leaving no

stumps whatever above the ground surface if the veld is to be cleared of this weed by means of the insect.

Felled Pear should not be Burned.

Some farmers prefer to burn the felled pear branches when dry; but burning is strongly condemned, for it destroys the humus furnished by the decayed pear and promotes soil erosion and completely eradicates all cochineal which is depended upon to deal with whatever regrowth may appear.

Pear Re-growth and Seedling Plants.

It is possible that in some limited areas under certain conditions a few felled pear branches, particularly if they happen to rest on bare ground contiguous with the surface, may strike root, resulting in some regrowth. Such branches may be satisfactorily dealt with at little additional expense, by turning them over with a two-pronged fork, a spade, or pick. An inspection of the area of felled pear is desirable about 18 months after the plants have been cut down in order to deal with such regrowth.

In most areas low-growing bush and surface stones prevent the cut-off pear branches from resting directly on the soil.

It is quite possible that after the veld has been cleared of prickly pear by means of felling, assisted by cochineal, seedling pear plants will appear over a considerable period. Some prickly pear seeds have been known to require 15 years to germinate. Such seedlings, if insufficient cochineal persists to deal with them, may easily be controlled by mechanical means.

Contour Systems for Orchards:

[Continued from page 738

constructed that in addition to delivering water for a section of trees, they could also be used for the removal of stormwater from the slightly higher section. Illustrations of dual purpose pipes and stepped furrows are given in Fig. 4.

Conclusion.

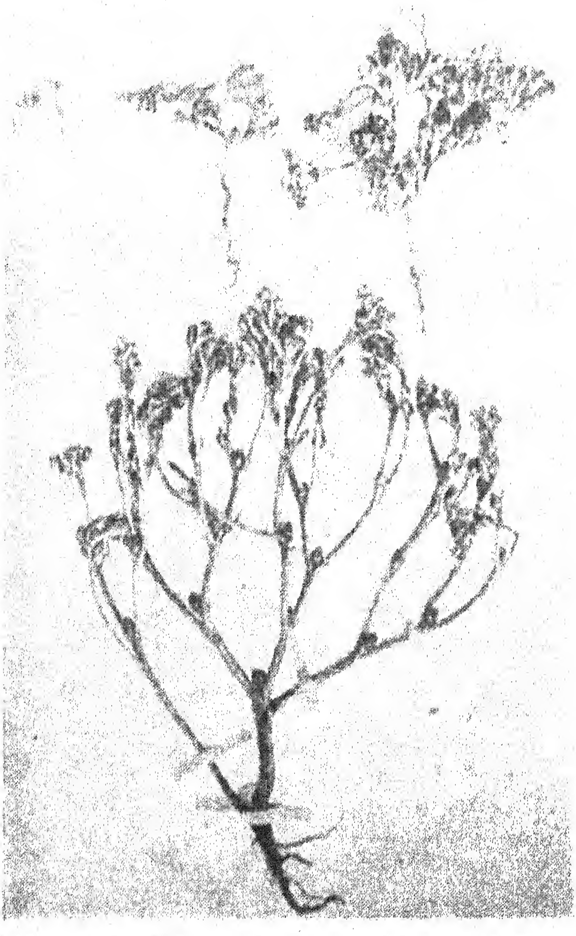
The choice of the best planting system for irregular slopes is not a simple matter but requires knowledge of the subject and discretion. To simplify matter where a decision is difficult, the best is to sketch the contour lines roughly on graph paper, according to scale when they have been established and marked. The approximate tree positions could then be plotted to suit the circumstances. Once a satisfactory system has been planned on paper it could easily be imposed on the land.

Farmers are encouraged to persevere when difficulties are encountered in the laying out of orchards on the contour system. Extra time and money spent on proper orchard layout will be well rewarded, not only in the time and money saved afterwards, but also in higher orchard productivity over a very long period.

"Vermeersiekte" in Stock.

Dr. Douw G. Steyn, Veterinary Research Officer, Onderstepoort.

"VERMEERSIEKTE" (vomiting sickness) is a disease in stock caused by the ingestion of the so-called "vermeerbossie" (vomiting bush), which includes several species of *Geigeria*. In the north-western districts of the Cape Province and in Griqualand West, for example, *Geigeria passerinoides* Harv. is almost solely



Geigeria Passerinoides Harv. The greater the lime content of the soil the smaller are the plants.

responsible for the disease. In Griqualand West, where the vermeersiekte problem was very acute during the period 1929-1930, and again during 1942-1943, another *Geigeria* species (*Geigeria pectidea* Harv.) has been found, and has proved to be even more toxic than the more widespread *Geigeria passerinoides*. In the western and northern Orange Free State, and also in certain parts of the south-eastern Transvaal (Standerton district), *Geigeria aspera* Harv. has in the past been responsible for heavy losses in sheep. This species also grows luxuriantly in isolated spots in the southern portion of the Ermelo district.

In experiments with *Geigeria zeyheri* Harv., which is of wide-spread occurrence in the Transvaal, the disease was artificially induced in sheep and goats at Onderstepoort. However, no authentic field report of the species *Geigeria zeyheri* as the cause of disease, has been received. A feasible explanation might be that the growth of this species of *Geigeria* is not as luxuriant as that of the other three named above.

Toxicity of the Various Species.

Geigeria aspera has proved to be the most toxic species, being about ten times as poisonous as *Geigeria passerinoides*. *Geigeria zeyheri* and *Geigeria pectidea* are about equally toxic, being about three times as poisonous as *Geigeria passerinoides*. It must be borne in mind, however, that the toxicity of the same species of plant growing in different localities may vary considerably. The active principle is *vermeeric acid*.

Symptoms.

Sheep and goats are more susceptible to the disease than are cattle. Even horses and donkeys have suffered from this disease.

For the sake of convenience, vermeersiekte is here divided into four different forms, namely: (*a*) the vomiting form, (*b*) the form in which hoven is the most outstanding symptoms, (*c*) the stiff form, and (*d*) the paralytic form. The various species of animals are usually affected in different ways, but generally one or more of these four forms of the disease occur together in the same animal.

Sheep.—Sheep usually show chronic vomiting and diarrhoea, but these symptoms are frequently combined with hoven and a stiff gait, most noticeable in the hindquarters. The first noticeable symptom is pronounced salivation, which progresses until vomiting occurs. It quite frequently happens, however, that sheep die suddenly after the ingestion of large quantities of *Geigeria aspera* and *Geigeria pectidea*, without showing any of the above symptoms. This also was found to be the case in drenching experiments with *Geigeria zeyheri*. When animals vomit and purge, the loss in condition is pronounced, and ultimately they are too weak to rise or walk about. When animals are in this state it is difficult to discriminate between actual weakness and partial paralysis (paresis). Affected animals will often be seen to vomit, and immediately afterwards to walk off and feed again. Respiration is accelerated and may be deep or shallow. The heartbeat is strong and accelerated in the beginning, but as the disease progresses, the pulse becomes weaker and weaker until it is imperceptible.

Goats.—In goats the disease bears a marked resemblance to that in sheep, although these animals appear to be more susceptible to the paralytic form, which is frequently associated with one or more of the other forms, mostly hoven and a stiff gait. The stiff gait may be regarded, however, as a preliminary stage of the paralysis.

Cattle.—These animals almost invariably exhibit the paralytic form. The disease usually sets in with pronounced salivation and a slow, stiff gait, sometimes accompanied by hoven and a marked loss in condition. Vomiting is a symptom rarely exhibited by cattle.

It may be of importance here to mention and explain a point often raised by farmers. We advise them to move animals affected with vermeersiekte onto green barley, oats, etc. Many farmers assert that the animals continue to vomit when allowed to graze on such green lands. They even maintain that healthy sheep on such

Geigeria Pectidea Harv.

lands will vomit; hence their difficulty in believing that the vermeerbossie are the only plants which cause true vermeersiekte. The explanation is simple: many, if not all ruminants, when fed on large quantities of green succulent plants, will have their lips stained with a greenish fluid which is frequently mixed with greenish ruminal contents. Owing to the high water content of these green succulent plants, the ruminal contents are semi-fluid, and during the process of rumination it is impossible for the animal to prevent "bringing up" with the cud, a quantity of the greenish fluid present in the rumen.

This kind of "vomiting", if it may be so termed, is extremely common among sheep in the Karroo when grazing on the luxurient growth of green succulent grass after the first summer rains have fallen.

Cause of Death in Vermeersiekte.

In vermeersiekte death may be due to (*a*) asphyxia caused by aspiration into the lungs of large quantities of the vomited ruminal contents, i.e., sufficient to cause instantaneous choking, (*b*) paralysis of the centre of respiration, (*c*) exhaustion caused by the incessant vomiting and diarrhoea, (*d*) heart failure, or (*e*) chronic or acute

pneumonia due to aspiration of small amounts of vomited ruminal contents into the lungs.

The writer has examined a large number of sheep on the point of death and found that in several cases the heart continued to beat for fully a minute or two after respiration had ceased completely.

Vomiting is probably caused by the toxin acting (*a*) locally on the mucous membrane of the rumen and (*b*) remotely, by stimulating the vomiting centre in the medulla oblongata.

Weeks and months after the actual vermeersiekte has disappeared from the farm, sheep may still die from chronic pneumonia which has developed as a result of the small quantities of the vomited ruminal contents drawn into the lungs.

Post Mortem Appearances.

Post mortem lesions depend on the form or forms of the disease from which the animals had been suffering. The lesions almost invariably found in all species of animals which have died from this disease are the following: lips moist with saliva or stained with vomited greenish-coloured ruminal contents and acute catarrhal gastro-enteritis. Furthermore, the following may be present: hyperaemia and slight oedema of the lungs; ruminal contents in the trachea and bronchi; acute or chronic bronco-pneumonia; hyperaemia of, and haemorrhages in the bronchial, mediastinal and retropharyngeal lymphatic glands, degeneration of the myocardium and liver, and oedema of the periportal lymphatic glands.

Treatment.

Farmers frequently administer paraffin, kerol and oil of turpentine to affected animals without the least success. Even if it were possible to find a remedy, it would be of little value, because as soon as a treated animal is released, it will again ingest the vermeerbossie. Consequently, the same animal will have to be treated several times in the course of a single day. Treatment would therefore be of use only if treated animals could be prevented from feeding on the plant again. Unfortunately, almost all farms in the vermeersiekte areas are severely infested with the plant, so that the only alternative is to "trek" with the animals. Should farmers desire to treat their animals, the only procedure we are at present able to recommend is the use of a purgative, followed by limewater, tannic acid and linseed oil, to relieve the gestro-intestinal irritation (see article on "Poisonous Plants", *Farming in South Africa*, February, 1937). Affected animals usually recover rapidly when they are moved on to pastures which are free of vermeerbos.

Prophylaxis.

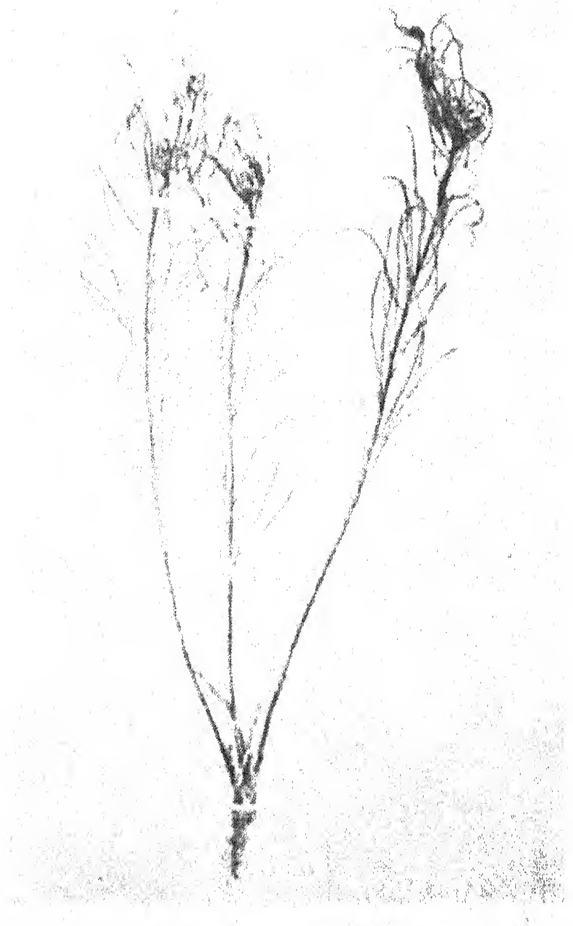
Many farmers maintain that *Geigeria passerinoides* is a good food for sheep, provided it is eaten in moderate quantities. This contention is quite acceptable in the case of this particular species of vermeerbos, but the other three species of *Geigeria* are too toxic to have any value as stock feeds.

The solution of the problem of vermeersiekte does not lie in the discovery of a remedy, but in the correct control of grazing and the eradication of the vermeerbossie.

The sooner farmers in the vermeerbos areas realize that there is at present little hope whatsoever of ever finding a cheap, reliable and lasting remedy for vermeersiekte, the better will it be for them and for the country.

Farmers are as a rule reluctant to attempt the eradication of these plants, as it seems such a hopeless task. It is incredible, however, what can be done when the problem is tackled energetically.

The great objection raised by farmers is the expense involved, but when it is considered that many farmers lose up to 80 per cent of their sheep through vermeersiekte, it is better to sell 10 per cent of the sheep and to use the money for eradicating the plant.



Geigeria Zeyheri Harv.

In the eradication of the plants a few important points should be considered. The *Geigeria* species are essentially annual plants, but during years when late summer or early autumn rains fall, the roots of many of the plants of this species may survive the winter, to sprout again in the next season. It is therefore essential that the bush should be pulled out and not cut off.

Many farmers have reported favourable results when animals are allowed to graze for about an hour on barley or oat lands before being allowed to graze on vermeerbossie veld. This method of preventing vermeersiekte is very strongly recommended.

It has also been our experience that stock which have free access to salt, bonemeal, or calcium phosphate licks are less subject to the disease than animals which are not provided with these licks.

During the past year, vermeersiekte once again caused heavy losses in Griqualand West, especially in sheep, but also in cattle. Vermeersiekte is one of the most serious problems of our livestock industry. The responsible bush (vermeerbossie) is rapidly increasing with the result that losses in stock are also increasing. The Griqualand West vermeerbossie (*Geigeria passerinoides*) is rapidly spreading in the Karroo. Outbreaks of vermeersiekte have already occurred in the Cradock district and the bush is also fairly widespread in the Middelburg district (Cape). Trekking with stock, more especially sheep, plays a very important rôle in the spread of the vermeerbossies. Apart from reports of serious outbreaks of vermeersiekte in the northern and western Orange Free State, the south-eastern Transvaal, South-West Africa and especially Griqualand West, we are continually receiving complaints from farmers about their losses in sheep, due to vermeersiekte. The sooner, therefore, this problem is energetically tackled, the better.

In the course of a recent investigation conducted in connection with the outbreak of vermeersiekte in Griqualand West, the great value of paddocking systems for rotational grazing as a solution to the vermeesiekte problem was once again demonstrated. Since 1928 Onderstepoort has been recommending this method as a permanent solution to the vermeersiekte problem. The investigation also showed to what extent sheep can help in eradicating or, at least, in limiting the spread of vermeerbossie, if farms are divided into camps, and one large camp is cleared of this pest.

A number of farmers who have applied this method for the past 5 to 7 years have already achieved considerable success in controlling the vermeerbossie.

We wish to repeat and to stress what has already been said about the prevention of this disease, namely, *that the solution to the problem of vermeersiekte does not lie in the discovery of a remedy, but in taking precautionary measures to prevent the disease by the following farming methods*:—

(1) Farms should not be continually overgrazed. Every farmer knows from experience to what extent overstocking has already damaged and still continues to damage our grazing. It is unnecessary to state that the continual burning of veld also causes incalculable damage to good grazing. Overgrazing greatly accelerates the spread of vermeerbos and other useless or poisonous plants.

In many cases animals are forced to feed on vermeerbos through lack of better grazing. It is therefore essential that stock should have good grazing. Since a good vegetal cover suppresses the vermeerbos to a large extent, as many useful grasses as possible should be encouraged on the veld. The harmful effect of continual overgrazing and veld burning will therefore be realized. But we have also seen that the spread of various species of bush, such as swarthaak (*Acacia detinens*) and others has an extremely deleterious effect on the vegetal cover of the veld. Very little, or no grass grows, where there is a dense stand of bush. Very dense bush is therefore very harmful to the veld.

Farmers who are experiencing an alarming increase of bush on their farms, should write to the Chief, Division of Soil and Veld Conservation, Steyn's Building, Pretoria.

2. *Paddocking systems are absolutely essential* if the vermeerbos is to be successfully controlled and our grazing built up. Details in this connection are also obtainable from the Chief, Division of Soil and Veld Conservation. *It is essential that someone with a good knowledge of the different types of grazing should divide up the farm into camps, otherwise more harm than good may be done:*

Geigeria Aspera Harv.

At least one large camp should then be cleared of vermeerbos. In the vicinity of native compounds or reserves labour is usually very cheap and several farmers who have availed themselves of such labour have cleared their whole farm of vermeerbos for £50 or less. The best method of eradicating the vermeerbos is to pull it out by hand, and to burn it when dry. Labourers should be paid per bagful or per bush, and not by the day. When a large camp is available, the following procedure should be followed: The camps which are still infested with vermeerbos must be tackled one by one, and should be very heavily grazed, temporarily, i.e., depending on the nature of the infested camp concerned, the number of sheep allowed to graze in it should be five to ten times the normal carrying capacity. It should be noted that the overgrazing must only be *temporary*, and not *continuous*, otherwise the veld will be trampled out. The object is to compel the sheep to feed on the vermeerbos, and the greater the

number of sheep allowed in such a camp, the less vermeerbos will there be for every sheep. It is possible that they will clear the veld of grass and vermeerbos within a week without becoming sick. Should vermeersiekte occur, however, the sheep should immediately be moved to the clean camp, where they will quickly recover. If the infested camps which have been overgrazed still contain vermeerbos, the sheep should be moved back as soon as the sick animals have recovered. This method of rotational grazing should be repeated as often as is necessary. In this way each infested camp should be tackled in turn. It is amazing to what extent sheep can help in solving the vermeersiekte problem. Wherever possible, lands may be made where the veld is overgrown with vermeerbos. The application of the above measures will not only help to control vermeerbos, but will also assist in restoring the pristine excellence of our grazing which has been destroyed to such a shocking extent. *It is essential that farmers should realize that our pastures have already been so seriously damaged by overgrazing, veld burning and incorrect grazing, that such menaces to the livestock industry as lamsiekte, internal parasites and plant poisoning are continually increasing, while the milk yield, vigour, wool production and breeding capacity of our animals are continually declining. If we do not now devote serious attention to the building up of our grazing, our descendants and their stock will be faced with disaster.*

The sheep farmer can successfully use his sheep to control the vermeerbos on his farm, but what of the cattle farmer who does not possess 800 sheep or more to use in the suggested system of rotational grazing? He is admittedly in a much less favourable position than the sheep farmer, since a large number of sheep are required not only for clearing the farm of vermeerbos, but also for continually controlling the plant once the farm has been cleared. If it is impossible for the cattle farmer to keep so many sheep on his farm, there is only one alternative and that is to clean the whole farm by pulling out the vermeerbos, and this will undoubtedly prove a costly undertaking where labour is difficult to obtain. It should also be borne in mind that in the absence of sheep, the vermeerbos will have to be pulled out continually, and this will further increase the costs. If a number of farmers co-operate and use their natives to clean each farm in turn, the costs will be much lower.

It is fully realized that the application of the grazing methods suggested above will require a great amount of fencing material and additional bore-holes, windmills and dams, but unless an immediate attempt is made not only to solve the vermeerbos problem, *but also to improve and build up our already badly damaged grazing, the future of the farming industry in South Africa will be very dark indeed.*

Eradication of the Vermeerbos by Insects.

So far as is known, there are three species of insects which feed on the vermeerbos. One of the species (a worm) is found in the flower, the second lives in the nodules on the roots in the form of a small caterpillar, while the third has been discovered for the first time this year, also on the roots of the vermeerbos. The first two species, which have been known for many years, do not seem to do the vermeerbos much harm. In Griqualand West, however, large patches of dead vermeerbos were observed where the ney species of insect occurred in large numbers, but on the other hand, there were also

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Growing Tobacco for Dipping Purposes.

With Special Reference to the Resistant Blue Tick.

P. M. Bekker, Division of Veterinary Services, and Pieter Koch, Principal Field Husbandry Officer.

AS is known, there exists at present in the East London area, a strain of the blue tick, *Boophilus decoloratus*, which cannot be effectively combated by the ordinary arsenical dips, in spite of the fact that the tick has in no way changed in external appearance or in its life cycle or in its habits, and that the chemical composition of the dip has not changed either.

In an extensive series of experiments, both at Onderstepoort and in the area concerned, a number of substances was tested out as additions to the ordinary arsenical dip. From these it was proved that the only efficient method of control was the regular dipping of cattle at intervals of 7 days in an arsenical dip of 7-day strength, i.e. 0·16 per cent. As_2O_3 to which tobacco extract (nicotine sulphate containing 40 per cent. nicotine) at a concentration of 0·04 per cent. nicotine had been added. Even then there will be cases where the animals will only be altogether free from the resistant blue tick after the seventh dipping.

Methods of Control.

Nicotine, 40 per cent.—The easiest way out of the difficulty would be the addition of 40 per cent. nicotine. Under present-day conditions, however, the tobacco extract in this form is exceptionally scarce and very expensive, exceeding £5 per 10 lb. (approximately 1 gallon) tin.

Scrap Tobacco.—As a result of the scarcity and exceptionally high prices of nicotine, an attempt was made to devise an inexpensive method by which the nicotine could be extracted from the scrap tobacco. This was successfully achieved, and the method which involves no expense and which consists of the direct lixiviation of the scrap tobacco in the dipping tank is described in an article: "Use of Waste Tobacco in Dips" by P. M. Bekker, reprints of which can be obtained from the Director of Veterinary Services, P.O. Onderstepoort.

The original idea had been to obtain the scrap tobacco from the co-operative tobacco companies, but a shortage of tobacco arose, with the result that this type of tobacco is now also used for smoking purposes. Consequently other sources had to be explored for supplies.

Plant Own Tobacco.

The only possible solution now is that farmers plant their own tobacco for their dipping requirements. It must be stressed that producers are in any case not allowed to sell their tobacco other than through the existing co-operative tobacco companies. The sole object is to encourage the growing of tobacco for use in dips only.

Quantity of Tobacco Needed.—In determining the quantity of tobacco needed, it is necessary to know, firstly, the nicotine content of the tobacco, furthermore the capacity of the dipping tank and the number of cattle. Assuming the nicotine content to be 2½ per cent., the capacity of the tank 3,000 gallons, and the number of cattle 200, then 600 lb. will be required to fill the tank at the start.

For every 100 gallons either way, 20 lb. of tobacco will have to be added or deducted. Thirty gallons of dipwash are approximately needed per animal per year, so that a further 7 lb. is needed per head. For 200 cattle therefore another 1,400 lb. will be required. The farmer with a 3,000 gallon tank and 200 head of cattle will need a total of 2,000 lb. of tobacco for the first year and 1,400 lb. for the following year, provided the tank is not cleaned out.

Growing Tobacco for Dipping Purposes.

Details of types of tobacco recommended for this purpose, where seed can be procured, how to plant, cultivate and cure the tobacco will now be described. It must, however, be emphasised that it is essential to know the nicotine content of the tobacco grown in order to know the amount needed for lixiviation. A representative sample (½ lb.) must be sent to the Director of Veterinary Services, P.O. Onderstepoort, for analysis and further advice how to use it for the eradication of the resistant blue tick and also the ordinary cattle lice, since Derris extract, which was previously used to combat lice is unobtainable for the duration of the war. Nicotine is, fortunately, a suitable substitute.

Varieties.—Two or three varieties of heavy dark tobacco are recommended, namely, the "Swazi" types like "Groot Swazi" and "Piet Retief Swazi", and the snuff types like "One Sucker" and "Clarksville". Seed of the former can be obtained from the Officer in charge, Hartebeestepoort Experiment Station, P.O. Box 90, Brits, Transvaal, and the latter from the Officer in Charge, Sub-tropical Horticultural Research Station, P.O. Box 70, Nelspruit, Transvaal, at 1s. per ounce. One ounce of clean seed, if properly sown and attended to, ought to supply sufficient seedlings to plant more than half a morgen, which should yield about 1,000 lb. of dark heavy strong tobacco, if heavily manured.

Soils.—Dark tobaccos are successfully grown on a greater number of soil types than other tobacco, the best for the purpose being produced on the heavier and more clayey soils rather than on the light sandy ones. Heavy manuring with kraal or nitrogen-rich manure materially promotes the yield and quality of dark, heavy tobacco rich in nicotine content.

Seedbeds.—The seedbeds are usually sown from July to end of September. A well-drained, light, loamy soil should be selected in a sheltered position for making the seedbeds. The site chosen must be in proximity to a permanent water supply as the beds need regular watering to be applied with a watering-can morning and evening until the seedlings are as big as a sixpence when one watering a day will suffice.

The soil for the seedbeds must be well dug over, and well rotted kraal manure should be liberally applied and dug in. The beds are then made 3 feet by any suitable length and covered with dry branches and thoroughly sterilised by burning. The ash is worked into the soil to a depth of about four inches and the beds raked as level and as smooth as possible, ready for sowing.

Most growers sow their beds too thickly. Mix a teaspoonful of clean seed with a few cups of wood ashes and sow to a bed of 3 feet by 20 feet. Five or six such beds ought to produce enough strong seedlings to plant a morgen of ground. After sowing pat the bed with the back of a spade, for as the seeds are very small every care should be exercised not to cover them by raking. Watering

should be done in such a way that the water does not run and so cause the seed to float to hollows and result in an uneven stand. Cover the beds with grass until the first signs of germination appear when the cover should be raised on cross sticks a few inches above the soil. Germination takes place from the sixth day and may take a fortnight or even longer, depending on whether it is warm or cold. Treat the beds in the same way as carrot beds. When the seedlings are two or three inches high the grass covering, which had in the meantime been removed for a short time every day, is removed altogether in order to harden the young plants for planting out in the land.

For the control of insect pests and bacterial and fungous diseases, weekly spraying with 1½ oz. of lead arsenate and 6 oz. of Bordeaux mixture to 4 gallons of water is recommended. Spraying is commenced as soon as the seedlings are as big as a threepenny piece. When the seedlings are 6 to 8 inches high they are ready for planting out in the land.

Planting out.—The soil must be well prepared before the seedlings are planted out, as it is essential for them to have favourable soil conditions for continuous growth. Where no irrigation is possible, the young plants are set out in the field during rainy weather, or when it is overcast. A cup of water to each plant will be a great advantage to make it strike and grow more readily. Where irrigation water is available, the problem of getting the plants to grow is naturally simplified. The plants are set out in rows 3½ to 4 feet apart and 3 feet in the rows.

Tobacco is a heavy feeder and to get the best results the soil should be well supplied with plant-food. For dark heavy tobacco suitable for dipping purposes, 30 to 40 tons of kraal manure to the morgen is recommended. Spread the manure evenly over the land and plough it in. The land is then harrowed and levelled, and 3½ ft. to 4 ft. wide furrows drawn for irrigable land ready for planting and watering; and for drylands the ground is left level and the plants set out as described.

Topping and Suckering.—Cultivation of the crop should start soon after the young plants have commenced growing. Cultivation is continued until the leaves have developed to such an extent that the operation would damage them. The plants are topped when the flower-heads emerge. For dark strong tobacco it is advisable to top low. Topping is a very important operation in the growing of all heavy types of tobacco. About twelve to sixteen leaves should be left to a strong plant and fewer to a weak plant.

As soon as the plant is topped young shoots or suckers start growing in the axils of the leaves. These suckers must be removed before they become large. It is usually necessary to remove the suckers twice during the season.

Harvesting.—Tobacco for dipping purposes should be cut when ripe. This ripening stage can easily be determined by the change in the leaf from a dark green colour to a decided mottled yellow; the leaf also becomes thicker and more brittle. It is advisable to cut the plant rather in a slightly overripe condition than when too green, especially for this class of tobacco. In cutting, the whole plant is removed by severing the stalk with a sharp knife or sickle just above the ground. As soon as the harvested plants have become sufficiently wilted to be handled, without undue breaking of the leaves, they are taken to the shed and hung up to dry. Green

sweating results in unnecessary loss of nicotine, and the plants should therefore be hung up within a day of harvesting. Tobacco for dipping purposes does not need the extreme care and attention in curing as is the case with tobacco for smoking or chewing purposes; the object is merely to dry the tobacco and retain the nicotine. Colour in tobacco for this purpose does not play an important part. The tobacco is cured or dried when the midrib is thoroughly dried out. During late summer, after the tobacco is dried, the air is usually sufficiently moist either during rainy weather or during the nights to soften the tobacco, so that it can be taken down and bulked, i.e., packed in a heap. Care must be taken that the heap does not overheat. Strip the leaves from the stalks as soon as possible. The leaves are then tied into bundles and stacked. Should the heap get warm it must be broken up, aired and restacked. The tobacco is then ready for dipping purposes.

Further particulars as to the growing of tobacco can be obtained from the Division of Animal and Crop Production, Pretoria.

"Vermeersiekte" in Stock:—

[Continued from page 754.

large patches of dead vermeerbos where no insects were to be found. There are indications, however, that this new species of insect is harmful to the vermeerbos, and the matter is now being investigated by the Division of Entomology.

Nursery Quarantines.

The following nursery quarantines were in force on 1 September 1943:—

(1) Page's Nurseries, Franschhoek, C.P., on citrus (all) for red scale.

(2) Beaulieu Nurseries, Forestdale Siding, P.B. Grahamstown, C.P., on citrus (all) for red scale.

(3) Municipal Nursery, Randfontein, on palms (all) for circular purple Ross and Spanish red scales.

Sale of Blowfly Spray.

The Onderstepoort Blowfly Spray is now obtainable from Dealers and Co-operative Stores, at 4s. per gallon.

Farmers must provide clean and air-tight containers.

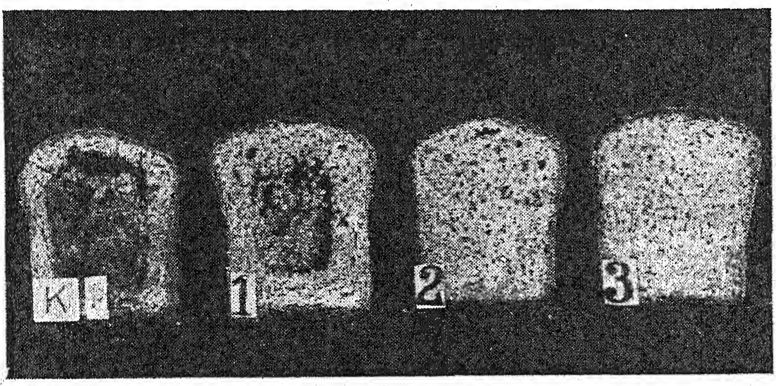
Dealers can obtain the blowfly spray from Onderstepoort or its substations at 3s. 6d. per gallon (in large drums).

Full particulars obtainable from Director of Veterinary Services, Onderstepoort.

The Prevention of Rope in Bread.

Dr. P. W. Vorster, Department of Agronomy, Stellenbosch-Elsenburg College of Agriculture.

A GOOD many housewives have had the experience that during warm summer weather their bread starts to become damp and sticky in the centre of the loaf, two or three days after baking. These damp spots develop until the whole loaf becomes a damp, sticky mass which develops a most unpleasant smell. If these sticky spots are touched, silky threads come away on the fingers—hence the name rope which is given to this condition.



The effect of vinegar on the development of rope in "standard" bread artificially infected with *B. mesentericus* and kept for 7 days at a temperature of 30° C. K.P.=untreated, 1=3·9 pints of vinegar, 3=7·8 pints of vinegar; all per 200 lb. bag of "standard" meal.

This bread disease is caused by bacteria of the *Mesentericus* group, also known as slime forming bacteria, which occur everywhere in the soil, so that any objects which come into contact with the soil often become infected. During harvesting time, and especially if wet weather prevails or if the crop lodges badly, the wheat becomes infected with the germs. When the wheat is threshed and milled, the meal also becomes infected. It is obvious therefore that the greater the quantity of bran which the meal contains, the greater will be the number of bacteria present. Consequently, whole-wheat meal generally has a much higher bacterial spore content than flour, and the chances for the development of rope are therefore much greater in the present "standard" bread.

Meal, however, is not necessarily the only source of infection. Sometimes compressed yeast also contains a large number of these bacterial spores. Furthermore, since these bacteria are present on the ground, it is obvious that if bread is baked and stored under unhygenic conditions, it will rapidly become ropy, even if the meal is free from germs.

This bread disease normally occurs in warm damp weather because the bacteria develop and multiply most rapidly at a temperature of about 30° C. (86° F.). A characteristic of these bacteria is that they can form spores under unfavourable conditions, and are so resistant to heat that they are not killed by the baking process. As soon as the bread cools down to about 40° C. (104° F.),

the spores germinate and the bacteria start multiplying. Another important characteristic of these bacteria is that they either develop very slowly, or not at all, under cold conditions. Experiments conducted in connection with the control of this disease in "standard" bread have shown, among other things, that even if the bread is severely infected artificially with these organisms, it will remain sound for about five days if cooled immediately after baking, and stored in a cool place at a temperature of 18° C. If, however, bread is stored at a temperature of 30° C. and kept under damp conditions, it will become ropy after the second day. It is therefore very important that bread should be cooled soon after its removal from the oven, and stored in a cool, dry, well-ventilated place.

It has also been found that if well-baked bread is stored in a dry place it will remain sound much longer than badly baked bread.

The Effect of Acidity.

Still another important characteristic of these bacteria is that they are very sensitive to acid conditions. As soon as the nutrient medium becomes slightly acid, the spores develop very slowly, if at all. This fact can be put to good use in controlling the disease. If bread is made slightly acid in one way or another, it does not readily become ropy. There are several well-known remedies for the control of rope, e.g., monocalcium phosphate, tartaric acid, acetic acid, vinegar, lactic acid, etc. Experiments conducted with "standard" bread have shown that ordinary brown commercial vinegar (4 per cent. acetic acid strength) is a very effective and inexpensive remedy for protecting bread against this disease. If five pints of vinegar per bag or three to four teaspoonfuls of vinegar for every pound of coarse meal used in mixing the dough are added, the bread should remain sound for at least five days, even under unfavourable conditions.

Although this quantity of vinegar is sufficient to prevent the bread from becoming ropy, it is not sufficient to affect the flavour of the bread. A much smaller quantity of vinegar may be used if the bread is stored in a cool, well-ventilated, dry place. During hot, damp weather greater care should be taken to prevent this disease.

Instead of vinegar, sourmilk or buttermilk may also be used to induce the acid condition in the dough. A fact worth noting is that in the old days when bread was baked exclusively with "ou-suurdeeg" (sour yeast) rope very rarely occurred in bread.

Another essential requirement in the control of rope is absolute cleanliness in baking. Mixing dishes, pans, etc., must be thoroughly cleaned after each bake. If rope should develop, it can be brought under control by thoroughly sterilizing all utensils in boiling vinegar water and then applying all the other preventive measures mentioned above.

Popular Bulletins.

(1) Calf Rearing—Bulletin No. 224. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

(2) The Export of Fresh Grapes from the Union of South Africa during the Ten-year period, 1930-39—Bulletin No. 225. Price 6d. Obtainable from the Chief, Division of Horticulture, Pretoria.

(3) Soft Cheese as a Food—Bulletin No. 229. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Official Milk Records.

Herd Averages for Registered Cows during 1941–2.

The average milk and butterfat records for registered herds officially tested during the year 1 September, 1941, to 31 August, 1942, are given hereunder. These figures are only in respect of registered herds of which all cows have been tested, and the records of all cows which completed a lactation during the period under review, are included. The records of cows in respect of which permission to withdraw has been granted in terms of Regulation 3 (*b*) of Government Notice No. 1430 of 1940, or which have died or were sold or were recorded for less than 120 days, have been omitted in calculating the herd averages. Herds of fewer than five cows and herds of which cows were withdrawn due to the shortage of feed are not included in these averages.

Owner's Name and Address.	Milk, lb.	Butterfat, %.	Butterfat, lb.	Days.	Number of Cows.						
					Mature.	Snr. 4.	Jnr. 4.	Snr. 3.	Jnr. 3.	2 Years.	Total.
FRIESLAND HERDS.											
S. D. le Roux & Son, Onverwag, Oudtshoorn, C.P.	13,440·9	3·559	478·385	300	4	—	—	3	1	3	11
S. Fourie, P.O. Box 142, Oudtshoorn, C.P.	13,976·6	3·387	473·350	300	4	—	—	1	2	—	7
van Niekerk Bros., Brakfontein, Bedford, C.P.	12,703·7	3·606	458·139	297	11	2	2	7	5	13	40
W. J. H. Spence, Pomona, Marquard, O.F.S.	13,251·2	3·432	454·828	300	4	1	—	1	—	3	9
A. E. Murray & Sons, Bloemhof, P.O. Glen Harry, C.P.	12,651·4	3·533	446·980	291	10	—	—	1	1	3	15
Sir de Villiers Graaff, Bart., De Grendel, Tygerberg, C.P.	12,615·9	3·509	442·673	298	10	6	5	4	6	8	39
W. J. J. Moolman, Grootspruit, P.O. Val, Tvl.	12,293·7	3·566	438·419	300	7	4	1	—	—	—	12
D. F. Muller, P.O. Box 26, Lady Grey, C.P.	11,447·6	3·778	432·537	296	7	2	4	7	5	13	38
Geo. Fergusson, Woodlands, P.O. Box 449, Benoni, Tvl.	11,516·2	3·694	425·355	300	4	1	2	4	2	2	15
S. L. van Niekerk, Kamnatie Loop, Oudtshoorn, C.P.	11,260·5	3·714	418·209	299	4	1	—	3	—	—	8
T. E. Murray & Sons, Roodebloem, Graaff-Reinet, C.P.	11,134·3	3·723	414·552	298	8	6	1	1	2	5	23
E. H. le Roux & Son, Langford, Somerset East, C.P.	11,346·4	3·598	408·254	298	9	2	4	5	6	11	37
R. V. Hulley, P.O. Kempton Park, Tvl.	11,408·0	3·533	403·049	300	6	2	2	—	1	2	13
Grootfontein College of Agriculture, Middelburg, C.P.	11,836·8	3·386	400·737	296	6	2	—	4	1	5	18
Mental Hospital, Bloemfontein, O.F.S.	11,511·5	3·463	398·690	300	14	3	1	1	5	4	28
Kiddie Bros., Rooidam, P.O. Modder River. O.F.S.	12,440·6	3·205	398·688	300	7	—	—	—	3	2	12
Frasers, Ltd., Aanvang, P.O. Jammersdrift, O.F.S.	10,891·3	3·617	393·940	297	8	3	3	1	2	5	22
Stellenbosch-Elsenburg, College of Agriculture, P.O. Muldersvlei, C.P.	10,902·1	3·565	388·696	299	17	3	4	3	6	18	51
A. A. Kingwill & Sons, Colonies Plaats, Graaff-Reinet, O.F.S.	10,516·2	3·693	388·395	289	4	1	1	6	1	16	29
J. J. Starke, P.O. Muldersvlei, C.P.	11,068·1	3·456	382·550	292	6	1	3	2	1	2	15
Mental Hospital, Queenstown, C.P.	10,333·1	3·674	379·632	297	3	6	2	—	2	10	23
W. M. Pfaff, P.O. Box 125, Ermelo, Tvl.	10,432·7	3·603	375·911	300	4	—	—	—	1	2	7
Dodds Bros., Thibet Park, Waverley, C.P.	10,191·2	3·672	374·227	293	10	1	—	1	1	—	13
School of Agriculture, Tweespruit, O.F.S.	9,453·5	3·884	367·217	299	3	1	2	1	2	4	13

Owner's Name and Address.	Milk, lb.	Butterfat, %.	Butterfat, lb.	Days.	Number of Cows.						
					Mature.	Snr. 4.	Jnr. 4.	Snr. 3.	Jnr. 3.	2 Years.	Total.
College of Agriculture, Glen, O.F.S.	10,196·3	3·597	366·716	299	7	1	1	1	2	3	15
J. N. le Roux, Jnr., De Luc, P.O. Vinies, O.F.S.	10,138·4	3·608	365·783	296	2	1	—	1	—	3	7
Dr. C. R. Henning, P.O. Box 23, Devon, Tvl.	10,768·8	3·396	365·694	300	3	1	1	—	2	2	9
W. P. Harris & Sons., P.O. Box 249, Kimberley, C.P.	11,159·7	3·273	365·299	299	24	2	5	6	3	17	57
P. G. Nelson, Schoonspruit, Malmesbury, C.P.	10,328·0	3·521	363·674	290	8	1	3	3	2	5	22
Agricultural Research Institute, Experimental Farm, Pretoria	9,885·3	3·642	359·981	298	1	1	2	5	—	4	13
C. Schwartz, Corona, P.O. Box 7, Virginia, O.F.S.	10,264·0	3·495	358·778	300	1	—	—	4	2	3	10
H. G. H. Brown, Schaffhausen, Waku, C.P.	10,171·6	3·489	354·917	300	5	1	3	1	—	2	12
H. W. Stockdale, Alma, Clocolan, O.F.S.	10,167·5	3·435	349·270	299	15	6	2	5	3	—	31
A. A. Montgomery, Hillside, Vineyard, O.F.S.	9,172·8	3·775	346·246	300	2	—	3	—	1	5	11
A. J. Combrink, Bloubank, Edenburg, O.F.S.	10,565·3	3·263	344·772	245	3	—	2	1	3	13	22
S. L. S. Cloete, Malangskraal, P.O. Bedford, C.P.	9,363·6	3·679	344·474	299	5	1	3	2	—	9	20
P. Hourquebie, Rosetta, Natal	9,786·5	3·495	342·070	300	11	4	3	3	6	6	33
J. H. Gertzen, Snr., Heathdale, Middelburg, C.P.	8,701·2	3·889	338·414	283	5	2	—	—	—	—	7
J. Starke, Easthill, P.O. Muldersvlei, C.P.	9,733·0	3·462	336·910	292	6	2	2	3	3	3	19
H. Oelrich, Oelrietta, Tweespruit, O.F.S.	9,537·7	3·494	333·262	300	5	—	—	—	—	—	5
F. J. van Zyl, Langverwacht, Bonnievale, C.P.	9,315·3	3·542	329·988	299	11	2	1	5	2	6	27
D. W. du Preez, P.O. Box 20, Standerton, Tvl.	9,383·4	3·492	327·680	300	5	1	—	1	—	—	7
Mrs. A. M. C. Botha, Eendracht, Heidelberg, Tvl.	9,408·1	3·474	326·861	237	6	1	2	2	—	—	11
Orpen & Son, Avoca, New England, C.P.	8,703·3	3·752	326·555	300	3	1	2	4	1	4	15
W. Hillhouse, Thornhill, Indwe, C.P.	9,269·1	3·497	324·132	281	5	—	—	—	—	—	5
Marlow Agricultural Training School, Cradock, C.P.	9,239·2	3·481	321·640	282	5	—	1	2	1	1	10
E. Starke, Joostenberg, Muldersvlei, C.P.	8,584·2	3·696	317·312	297	9	6	—	4	3	10	32
Geo. Dunbar, P.O. Box 11, Delmas, Tvl.	10,223·8	3·092	316·137	297	20	3	5	7	6	16	57
Estate late J. I. Starke, P.O. Muldersvlei, C.P.	8,728·9	3·620	316·019	293	8	1	—	1	—	5	15
Baynesfield Estate, P.O. Nels Rust, Natal	8,621·7	3·662	315·755	297	37	7	10	9	9	16	88
A. Neizel, Erasmusdam, P.O. Glenisla, Natal	9,106·5	3·435	312·853	292	5	1	2	—	—	3	11
D. S. E. Marais, Fern Grove, Lady Grey, C.P.	8,151·5	3·830	312·176	300	1	1	—	2	1	6	11
Mrs. M. A. Toens, P.O. Box 502, Bloemfontein, O.F.S.	8,928·5	3·484	311·061	287	3	2	—	—	—	—	5
Valkenberg Mental Hospital, Observatory, C.P.	9,437·4	3·288	310·325	290	9	1	1	1	2	4	18
D. J. Marais, Marloura, Glenroy, Tvl.	9,416·0	3·272	308·058	283	5	—	1	—	1	—	7
M. Schultz, P.O. Box 71, Davel, Tvl.	9,336·2	3·235	302·020	299	4	—	1	3	2	2	12
J. H. le Roux & Son, Bakenskraal, Oudtshoorn, C.P.	8,283·3	3·628	300·496	286	20	8	3	15	7	6	59
Field-Marshal J. C. Smuts, Doornkloof, Irene, Tvl.	8,962·4	3·324	297·898	272	7	1	—	1	—	4	13
Isted & Son, Halstone, P.B. New England, C.P.	8,281·7	3·544	293·482	294	3	1	—	4	—	3	11
P. Olivier, The Towers, Oudtshoorn, C.P.	9,436·0	3·076	290·238	291	5	—	3	—	2	13	23
D. Joubert, Baltana, Stellenbosch, C.P.	8,251·6	3·492	288·134	300	7	—	—	1	—	—	8
G. J. Veenstra, Shirley, Mooi River, Natal	8,102·3	3·555	288·027	299	10	3	4	2	4	9	32
M. Naude, McCabespruit, Clocolan, O.F.S.	7,978·0	3·587	286·186	280	9	4	3	2	1	4	23
E. J. du Toit, Celidon, P.O. Box 36, Barkly East, C.P.	7,806·2	3·663	285·946	300	2	1	—	1	1	—	5
R. R. Cullinan, Olifantsfontein, Tvl.	8,720·5	3·258	284·146	296	9	—	1	—	—	—	10
A. & E. G. Wevell, P.O. Box 59, Bethal, Tvl.	8,286·0	3·349	277·517	300	5	1	—	—	1	1	8
H. G. Bright, Berwyn Mountain, Ficksburg, O.F.S.	7,611·0	3·521	267·959	277	3	3	—	1	2	—	9

S. G. Basson, Doornfontein, Malmesbury, C.P.	7,432·6	3·595	267·233	275	3	—	1	1	3	4	12
Durban North Dairy, 179 High Ridge Road, Durban North, Natal	8,362·0	3·191	266·801	254	3	—	1	—	1	—	5
Mrs. R. du Preez, P.O. Box 272, Bloemfontein, O.F.S.	7,494·7	3·552	266·193	294	—	—	1	1	—	3	5
I. P. Meyer, Mareuil, Bethlehem, O.F.S.	7,667·5	3·440	263·759	272	5	—	—	—	—	2	7
Mrs. W. R. Swanepoel, Tasmania, Jamestown, C.P.	7,704·8	3·402	262·095	270	4	—	—	—	—	2	6
W. A. Shaw, Shaftesbury, Westminster, O.F.S.	7,848·9	3·281	257·530	271	8	1	3	3	4	2	21
Mrs. S. Brown, Spitskop, P.O. Meadows, O.F.S.	7,830·8	3·265	255·639	300	2	—	2	2	6	1	13
C. E. Sherwood, P.O. Box 53, Davel, Tvl.	6,803·1	3·745	254·747	270	22	3	8	1	5	17	56
O. H. Kiessig, Hartmanshoop, Philippolis, O.F.S.	7,573·0	3·351	253·745	297	—	—	3	1	3	4	11
Miss T. Vigne, Rust-en-Vrede, P.O. Box 107, Kimberley, C.P.	7,785·8	3·244	252·564	281	7	3	—	1	—	1	12
P. H. Viljoen, Geluk, Clocolan, O.F.S.	7,141·1	3·417	244·030	280	2	2	—	2	—	3	9
J. S. Vermaak, Vermaakskraal, Helpmekaar, Natal	6,769·5	3·592	243·188	231	3	1	1	—	—	4	9
J. A. Rautenbach & Co., Eden, P.O. Box 142, Kroonstad, O.F.S.	6,683·1	3·613	241·469	289	31	9	7	6	5	4	62
Industrial School, Heidelberg, Tvl.	6,409·4	3·707	237·566	294	6	1	—	1	2	—	10
A. Finnemore, The Beacon, P.O. Theunissen, O.F.S.	7,034·4	3·335	234·581	285	1	1	1	—	—	3	6
T. S. Leask & Co., Highlands, Wolmaransstad, Tvl.	7,141·9	3·215	229·584	300	7	—	—	—	2	—	9
Dr. C. M. Rautenbach, P.O. Box 43, Bloemfontein, O.F.S.	6,317·0	3·592	226·892	291	6	1	2	2	1	3	15
H. T. Gertenbach, Grootfontein, Philippolis, O.F.S.	6,143·6	3·630	222·994	300	—	1	2	1	—	1	5
J. S. Henning, Sweetwaters, Louis Trichardt, Tvl.	6,592·4	3·363	221·713	261	2	—	3	—	2	—	7
A. L. Meyburgh, Romansfontein, Molteno, C.P.	6,166·2	3·565	219·823	223	5	—	—	—	—	—	5
O. W. Vice, Wynnedale, Molteno, C.P.	6,041·8	3·560	215·082	293	6	—	—	1	—	—	7
Harrowdene Estates, P.O. Box 6101, Johannesburg, Tvl.	5,692·7	3·656	208·098	270	5	3	4	3	—	—	15
A. B. Lombard, Omega, P.O. Box 57, Clocolan, O.F.S.	6,093·0	3·413	207·971	259	8	1	1	—	—	6	16
L. G. Gertenbach, Grootfontein, Philippolis, O.F.S.	5,582·9	3·579	199·827	283	1	3	—	4	1	3	12
Industrial School, Meadows, O.F.S.	5,152·0	3·704	190·844	258	5	1	1	—	—	—	7
J. P. Beket, Erfdeel, P.O. Lindley, O.F.S.	5,297·2	3·473	183·990	274	5	3	5	—	2	—	15
D. Finnemore, Koppieskraal, P.O. Theunissen, O.F.S.	4,847·7	3·643	176·604	234	2	1	—	1	2	3	9
W. J. de Wet, Pauciflora, P.O. Lindley, O.F.S.	5,082·7	3·495	177·618	263	5	4	—	1	1	2	13
L. C. Serfontein, Geduld, P.O. Bosrand, C.F.S.	4,214·2	3·492	147·145	251	11	—	1	1	2	—	15
Mrs. A. A. Strasheim, Uitenhage, Springfontein, O.F.S.	3,598·2	3·554	127·897	239	7	1	1	—	1	—	10
JERSEY HERDS.											
A. Luckhoff, Zuurplaats, Graaff-Reinet, C.P.	9,162·3	5·079	465·312	293	2	—	1	—	3	3	9
H. L. D. Wood, Jersey Farm, Retreat, C.P.	9,348·3	4·682	437·657	291	13	2	3	3	—	11	32
Wright Bros., Westoe, Highlands Rail, C.P.	8,320·1	4·991	415·253	296	4	3	3	2	1	3	16
Grootfontein College of Agriculture, Middelburg, C.P.	8,302·1	4·997	414·888	278	2	—	1	—	2	3	8
Marsh Memorial Homes, Rondebosch, C.P.	8,489·2	4·655	395·183	299	5	1	—	2	1	2	11
A. W. Boss, P.O. Box 2407, Cape Town, C.P.	8,022·1	4·908	393·697	252	4	2	3	1	2	1	13
J. Neil-Boss, The Meadows, P.O. Hankey, C.P.	7,271·8	5·260	382·522	300	7	1	1	4	—	6	19
Stellenbosch-Elsenburg College of Agriculture, P.O. Muldersvlei, C.P.	6,599·7	5·434	358·655	299	1	—	—	—	1	10	12
R. Porritt, 217 Alexandra Road, Pietermaritzburg, Natal	7,162·0	4·773	341·871	283	1	1	—	—	—	5	7
F. Dammann, P.O. Box 39, Glencoe, Natal	5,909·8	5·641	333·346	292	2	—	1	—	1	1	5
G. R. Hugo, Salomonsvlei, Klein Drakenstein, C.P.	6,889·8	4·833	332·967	300	1	—	1	1	1	5	9
S. Hugo, Rust-en-Werk, Daljosaphat, C.P.	7,533·4	4·350	327·724	297	10	3	1	—	1	7	22
A. Nicholson, Schoongezicht, Stellenbosch, C.P.	6,831·0	4·767	325·615	300	3	1	—	—	—	2	6
Oakdale Agricultural Training School, Riversdale, C.P.	6,344·2	5·097	323·345	298	8	1	—	4	2	4	19
E. Mills, Hillside, P.O. Sidbury, C.P.	6,063·3	5·214	316·116	300	5	—	—	2	—	7	14
M. Hodgson, 17 Egerton Road, Kimberley, C.P.	6,089·7	4·812	293·044	269	5	—	—	1	—	2	8
A. C. Jolly, Thorneycroft, Sevenfountains, C.P.	5,667·4	4·989	282·737	279	6	—	3	—	6	4	19

Owner's Name and Address.	Milk, lb.	Butterfat, %.	Butterfat, lb.	Days.	Number of Cows.						
					Mature.	Snr. 4.	Jnr. 4.	Snr. 3.	Jnr. 3.	2 Years.	Total.
G. Vernon Crookes, Moyeni, Renishaw, Natal	5,161·3	5·402	278·804	295	10	3	3	4	4	7	31
Mrs. B. H. V. Handley, Normanby, P.B. Pietermaritzburg, Natal	4,591·1	5·682	260·863	288	2	1	2	1	3	3	12
H. F. C. Kiisel, Honey Grove, P.O. Harburg, Natal	5,330·8	4·670	248·934	295	3	1	2	—	2	5	13
R. R. Fowlds, Meadowfield, Sandflats, C.P.	4,781·1	4·848	231·769	264	2	—	—	—	1	4	7
A. G. Lovemore, Handfield, P.O. Sandflats, C.P.	4,352·3	4·952	215·530	300	1	2	1	—	1	3	8
Mrs. M. G. Ellis, P.O. Box 31, Mooi River, Natal	4,105·9	5·152	211·524	208	4	1	2	1	4	1	13
Miss E. I. Newdigate, Portland, P.O. Highway, Knysna, C.P.	4,446·0	4·452	197·188	253	5	—	3	2	2	2	14
A. J. Versfeld, Groote Post, Darling, C.P.	3,755·9	5·024	188·718	221	9	2	4	8	4	7	34
SHORTHORN HERDS.											
H. T. C. Sills, Jnr., Sudbrook, Dordrecht, C.P.	8,793·2	4·410	387·803	294	—	—	1	2	—	2	5
H. T. Sills & Son, Carlton, Dordrecht, C.P.	6,543·7	4·019	263·018	300	2	—	—	1	2	5	10
R. W. C. Whitehead, Lucia, P.O. Box 235, Bethlehem, O.F.S.	6,087·6	4·086	248·749	299	13	2	—	3	1	—	19
G. F. Sheard, Quagga Heights, Toise River, C.P.	6,046·9	4·075	246·404	296	3	—	1	1	—	—	5
Baynesfield Estate, Nels Rust, Natal	6,251·1	3·646	227·908	300	5	—	—	1	2	2	10
W. Minnaar, P.O. Box 22, Bethulie, O.F.S.	5,972·4	3·795	226·648	291	7	—	3	2	—	4	16
H. A. H. Smith, Woburn, Alice, C.P.	4,654·4	4·073	189·587	235	7	—	1	1	1	1	11
P. J. de Wet, Grootschuur, Sterkstroom, C.P.	4,464·0	4·092	182·654	233	7	1	—	4	2	1	15
D. C. Flower, Whyteleaf, P.O. Rosetta, Natal	4,235·0	3·839	162·578	288	3	1	2	—	—	—	6
J. H. Diesel, Floradale, P.O. Box 161, Bloemfontein, O.F.S.	3,964·5	3·768	149·370	207	17	2	3	3	6	7	38
AYRSHIRE HERDS.											
Montague Simpson, P.O. Box 6245, Johannesburg, Tvl.	9,437·9	4·059	383·045	275	9	3	5	2	2	4	25
D. S. Fowler, Umgeni Poort, Nottingham Road, Natal	8,046·6	3·744	301·274	292	8	1	3	2	—	3	17
Cape Explosives Works, Somerset West, C.P.	8,858·9	3·259	288·675	283	12	8	4	4	1	2	31
A. C. Donian, Reserve Dairy, Kingwilliamstown, C.P.	7,230·5	3·975	287·439	239	4	2	—	—	—	1	7
B. W. Reynolds, Hayfields, Glencoe, Natal	5,386·7	3·807	205·072	264	9	5	3	3	1	2	23
Mrs. A. R. Lloyd, Edgehill, Mooi River, Natal	5,387·2	3·569	192·264	217	7	1	3	1	—	—	12
College of Agriculture, Cedara, Natal	4,025·3	3·920	157·800	192	6	6	1	1	2	1	17
RED POLL HERDS.											
Parker Bros., Melrose, Eastpoort, C.P.	8,360·0	3·718	310·789	300	2	3	6	—	1	—	12
Experimental Station, Dohne, C.P.	5,967·3	4·166	248·593	290	6	3	—	6	2	1	18
Quin Bros., Bishop's Glen. Glen, O.F.S.	4,891·9	3·495	170·952	246	14	3	3	3	1	1	25
Estate C. W. Champion, Balaclava, Tweespruit, O.F.S.	4,757·1	3·465	164·813	285	6	—	1	—	1	4	12
GUERNSEY HERDS.											
H. J. van Aarde, Delectus, Bainsvlei, Bloemfontein, O.F.S.	9,407·2	4·314	405·841	296	3	—	—	1	1	3	8
College of Agriculture, Potchefstroom, Tvl.	6,126·5	4·678	286·622	222	4	—	—	—	—	1	5
D. Labistour, Umgai Farm, P.O. Ifafa, Natal	4,909·4	4·377	214·879	300	4	1	—	—	1	2	8
W. E. Lovemore, P.O. Box 23, Sandflats, C.P.	4,131·2	4·450	183·849	259	5	—	—	—	2	—	7
BROWN SWISS HERDS.											
G. C. Heathcote, Whitney, Alexandria, C.P.	4,781·4	4·071	194·651	199	5	1	—	—	1	1	8

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 · OCTOBER 1943 No. 254

CONTENTS

* Price Review for August, 1943.

SLAUGHTER CATTLE.—Larger supplies of good quality cattle, including a reasonable number of National Mark Primes and Supers reached the market during the month. Prices were on a somewhat lower level at the beginning of the month, but advanced again towards the end. On the Durban market, however, maximum prices were realized right through for all classes, as a result of the strong demand. Ordinary primes on the Johannesburg market averaged 70s. 8d. per 100 lb. estimated dressed weight on the hoof, good mediums 65s. 3d. and compounds 56s.

Slaughter Sheep.—Moderate supplies were on the markets and consisted mostly of merinos. Crossbreds were exceptionally scarce. The demand, especially for prime qualities, was lively and prices on the whole were higher than for the previous month. Prime merinos on the Johannesburg market rose from 11·4d. per lb. estimated dressed weight to 11·8d. per lb. for August, and prime crossbreds from 10·3d. to 10·8d. per lb. On the Cape Town market prime merinos rose from 11·4d. per lb. in July to 12·4d. per lb. in August, and prime crossbreds from 11·2d. to 12·2d. per lb.

Grain and Hay.—Dry beans were present in somewhat smaller quantities and prices of all varieties advanced, e.g. speckled sugar beans were 53s. 11d. per bag as against 46s. 9d. the previous month and cowpeas 33s. as against 29s. 9d. per bag. Dry peas were also scarcer but prices showed little change.

All kinds of hay, and especially Cape lucerne, were present in smaller supplies than for the previous month, and lucerne, teff and oats were mostly sold at the fixed maximum prices. Only sweetgrass was present in reasonable quantities.

Potatoes.—Heavy supplies, especially of Free State potatoes, were on the markets and huge carry-overs occurred almost daily.

* All prices mentioned are average.

Prices as a result dropped to quite an extent, except for National Mark potatoes which were offered in fairly moderate quantities. Bad weather during the third week of the month, resulted in supplies again decreasing and prices improved again somewhat. Average prices for the month, however, were much lower than for the previous month, except on the Cape Town market. Transvaal No. 1 on the Johannesburg market was 13s. 5d. per bag for August as against 16s. 4d. for July, while National Mark Grade I, No. 2 and 3 remained practically unchanged, viz. at 21s. 3d. and 21s. 7d. per bag respectively.

Onions.—In spite of larger supplies of especially Cape onions, prices in general advanced. Cape onions on the Johannesburg market were 23s. 3d. per bag for August, as against 20s. 2d. for July and 21s. 4d. as against 16s. 5d. per bag on the Cape Town market.

Tomatoes.—Were on the whole still very scarce and dear. National Mark quality, on the Johannesburg market, averaged 7s. 11d. per tray for August.

Vegetables.—Were still very scarce. Consignments green beans, squashes and vegetable marrows from the Transvaal Lowveld increased somewhat, especially on the Johannesburg and Pretoria Markets and prices declined slightly. Cauliflower was fairly plentiful at the beginning of the month but gradually diminished. Offerings of other vegetables on the whole were small and the demand very keen.

Fruit.—Valencias as well as seedlings were present in bigger quantities on the markets, and experienced a reasonable demand. Pawpaws were also fairly plentiful but prices changed very little.

Eggs.—Smaller supplies than during the previous month as well as during the corresponding month the previous year, were present. This is on account of the general scarcity of feedstuffs and probably also as a result of the exceptionally cold weather during the month. Prices everywhere declined slightly.

Index of Prices of Field Crops and Animal Products.

This index, as shown elsewhere, remained unchanged for August, viz. at 153.

Only a slight decline occurred in the group "Other Field Crops", viz. from 186 in July to 182 in August, caused by the drop in the price of potatoes; and in the group "Poultry and Poultry Products", viz. from 185 to 172 in August. The remaining groups all showed very little or no change.

Volume and Value of Sales of Citrus Fruit on the Eight Most Important Municipal Markets of the Union.

In the July 1942 issue of *Crops and Markets*, particulars were given of the total volume of sales and values of citrus fruits sold on the eight most important municipal markets in the Union, from 1937 to 1941.

These figures have now also been calculated for 1942, and in the table below the annual quantities and values sold on the eight markets from 1937 to 1942 are given.

The eight markets comprise the municipal markets of Pretoria, Johannesburg, Bloemfontein, Cape Town, Port Elizabeth, East London, Durban and Pietermaritzburg.

	1937.	1938.	1939.	1940.	1941.	1942.
Quantities sold............Tons	34,350	33,970	41,620	41,660	44,010	51,260
Total value..............£1,000	205·8	207·4	220·6	251·6	313·0	485·0

(Citrus fruit include oranges, lemons, grapefruit).

From this table it appears that the volume of citrus fruit sold on the eight municipal markets had increased by about 50 per cent. from 1937 to 1942, while the value at which it was sold had increased by over 130 per cent.

These figures, of course, only include quantities which were sold on the municipal markets on the eight cities and do not include that which were disposed of outside the market through various other channels.

In the table given below the quantities of citrus fruits which were sold monthly during 1942 on each of the eight municipal markets are indicated:

Quantities of Citrus Fruit sold on each of Eight Municipal Markets. (In 100 lb. Quantities.)

1942.	Johannesburg.	Pretoria.	Bloemfontein.	Cape Town.	Port Elizabeth.	East London.	Durban.	Pietermaritzburg.
January................	7,479	2,158	554	5,354	1,600	870	5,104	842
February................	5,150	2,036	344	2,107	1,349	443	1,660	528
March................	6,742	2,195	731	2,508	968	594	402	425
April................	33,213	9,279	3,476	15,492	2,626	1,594	7,206	2,990
May................	35,250	9,807	3,157	21,143	2,659	2,411	12,294	2,634
June................	39,538	9,908	4,009	27,268	5,254	4,404	13,318	4,472
July................	55,546	15,467	6,323	48,277	7,785	6,121	24,678	7,631
August................	42,083	13,061	4,703	26,355	6,389	4,823	14,546	4,742
September................	48,199	14,300	5,918	34,729	8,433	6,161	19,150	5,980
October................	36,746	8,863	4,645	22,177	6,655	5,298	16,090	4,995
November................	27,848	11,809	4,296	19,960	6,734	4,970	14,063	3,401
December................	20,415	11,535	2,155	14,520	4,019	4,073	10,026	2,884
TOTAL, 1942....	358,207	110,418	40,311	239,889	54,470	41,762	138,537	41,523
1941....	328,159	119,739	42,108	236,922	44,214	34,206	32,520	42 368

In the table below the average monthly values per 100 lb. of citrus fruit sold on each of the eight municipal markets are again indicated:—

Average Value of Citrus Fruit sold on each of Eight Municipal Markets (PER 100 lb.)

1942.	Johannesburg.	Pretoria.	Bloemfontein.	Cape Town.	Port Elizabeth.	East London.	Durban.	Pietermaritzburg.	Total Average.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January........	14 5	14 11	14 4	19 2	8 5	12 3	16 4	17 1	15 7
February........	16 1	14 3	13 5	24 0	7 7	10 1	18 3	18 9	16 4
March........	10 7	12 3	6 3	20 9	7 5	8 4	12 11	13 2	12 2
April........	6 9	6 4	5 10	8 11	7 4	7 4	10 2	7 11	7 6
May........	8 2	7 5	8 7	8 5	8 10	7 3	8 1	8 8	8 2
June........	8 1	7 9	7 10	7 11	7 8	6 7	8 6	8 5	8 0
July........	8 4	8 1	8 1	7 7	8 0	7 5	8 11	8 2	8 1
August........	8 4	8 0	8 8	10 5	8 4	7 9	7 11	9 0	8 9
September........	8 2	8 1	8 2	10 2	8 1	8 6	8 11	8 3	8 9
October........	9 0	10 2	9 5	12 4	9 6	7 6	9 8	8 2	9 10
November........	14 0	12 1	9 8	13 3	10 3	7 1	12 1	12 4	12 5
December........	12 11	12 3	9 4	15 8	11 0	9 8	15 8	13 3	13 4
Average........	9–2	9–2	8–6	10–5	8–8	7–10	10–1	9–4	9–6

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON (1st July to 30th June).	Summer Cereals. (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Stock. (e)	Dairy Products. (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936-37.........	118	86	94	93	122	86	89	98	106
1937-38.........	89	106	112	118	98	112	105	107	101
1938-39.........	92	107	96	89	79	102	106	94	93
1939-40.........	86	106	77	93	116	105	106	89	104
1940-41.........	109	113	106	159	103	108	110	112	109
1941-42.........	121	132	145	205	101	131	134	163	124
1942-43.........	160	149	151	159	115	148	167	184	145
1943—									
January.......	160	154	132	113	115	139	165	150	141
February......	163	154	130	112	115	139	156	179	142
March.........	161	154	142	119	115	139	160	216	145
April.........	159	154	142	140	116	139	163	262	148
May...........	169	154	144	155	116	163	165	316	156
June..........	169	154	165	165	116	163	166	202	150
July..........	170	154	174	186	116	176	182	185	153
August........	170	154	175	182	116	176	183	172	153

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay.
(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins.
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls, turkeys and eggs.

Average Prices of Potatoes and Onions on Municipal Markets.

SEASON (1st July to 30th June)	POTATOES (150 lb.).						ONIONS (120 lb.).		
	Johannesburg.				Cape Town.	Durban.	Johannesburg.	Johannesburg.	Cape Town.
	Transvaal. No. 1.	Transvaal. No. 2.	N.M. Grade 1. No. 2.	N.M. Grade 1. No. 3.	Cape No. 1.	Natal No. 1.	Transvaal.	Cape.	Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39.........	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940-41.........	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941-42.........	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942-43.........	13 7	12 6	15 8	15 11	15 0	16 9	13 8	14 0	12 6
1942—									
January.......	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February......	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March.........	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April.........	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May...........	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June..........	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July..........	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August........	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September.....	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October.......	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November......	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December......	11 6	9 6	14 1	13 3	12 2	15 6	9 3	10 11	11 9
1943—									
January.......	7 9	6 8	10 9	10 8	10 9	14 2	8 5	9 4	7 8
February......	8 3	7 2	11 8	11 6	8 4	13 7	7 10	10 9	7 8
March.........	8 10	8 5	13 1	12 7	8 4	13 9	8 1	11 0	7 3
April.........	11 5	11 1	15 8	15 0	13 0	14 7	11 6	12 10	9 10
May...........	12 6	12 2	15 11	15 5	15 6	16 3	16 4	15 8	13 2
June..........	12 11	14 1	19 9	19 0	14 6	17 9	17 3	17 4	14 3
July..........	16 4	15 11	21 5	21 4	18 1	18 10	17 9	20 2	16 5
August........	13 5	12 5	21 3	21 7	19 0	15 3	17 8	23 3	21 4

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb.						Pigs per lb. Live Weight.		
	(a) Johannesburg.				(b) Durban.		Johannesburg.		
	N.M. Prime.	Ordinary Prime.	Good Medium.	Com-pounds.	Medium.	Com-pound.	Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938–39	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940–41	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941–42	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942–43	67 4	63 2	57 9	46 1	45 6	35 9	7·2	8·6	6·9
1942—									
January	62 3	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
October	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2
April	65 6	60 8	55 8	43 4	42 1	33 11	6·9	9·1	6·5
May	65 0	59 11	55 3	43 9	42 6	37 6	7·6	8·7	6·6
June (d)	36 3	32 7	29 7	23 1	42 6	37 0	8·3	8·7	7·4
		No. 1.	No. 2.	No. 4.					
July (d)	40 9	37 5	34 6	27 6	45 6	41 0	8 4	8 6	7 1
August	75 8	70 8	65 3	56 0	49 0	44 0	8·4	8·7	7·2

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.
(d) For June and July, 1943, prices were quoted per 100 lb. live weight.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June to 31st May).	Johannesburg.				Cape Town.			
	Merino Wethers.		Persians and Cross Breds.		Merinos.		Capes and Persians.	
	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938–39	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940–41	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941–42	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942–43	11·5	9·8	9·8	8·3	10·7	9·8	10·5	9·6
1942—								
January	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March	9·6	814	8·8	7·9	9·6	8·8	9·3	8·8
April	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
October	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·4
February	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·1
March	11·5	9·8	9·0	7·3	11·7	10·6	11·1	10·2
April	12·0	10·2	9·5	7·7	12·4	10·9	11·6	10·8
May	12·0	10·3	9·6†	7·9†	11·1	10·1	11·1	10·3
June	11·4	10·2	10·4	9·2	10·8	10·5	11·0	10·2
July	11·4	10·3	10·3	9·3	11·4	10·2	11·2	9·9
August	11·8	10·2	10·8	9·3	12·4	11·6	12·2	11·1

* As sold on the hoof. Reported by Meat Control Board.
† As from June "other hamels".

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

SEASON (1st July to 30th June).	CABAGES (Bag). (a)			CAULIFLOWER (Bag). (a)			TOMATOES (Trays 15 lb.).			
							Johannesburg.			
	Johan-nesburg.	Cape Town.	Durban.	Johan-nesburg.	Cape Town.	Durban.	N.M. No. 1.	Other.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d'	s. d.	s. d.	s. d.
1938-39	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940-41	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941-42	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1942-43	5 6	5 11	9 1	5 0	5 9	7 6	3 4	1 10	2 1	2 7
1942—										
January	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
September	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
October	4 2	6 10	2 5	—	4 9	5 5	2 6	1 5	2 0	1 4
November	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10
December	3 11	7 10	3 2	—	4 0	—	3 8	1 10	3 0	2 4
1943—										
January	5 1	9 0	12 6	—	—	—	4 11	2 4	2 6	2 8
February	6 4	10 2	15 2	5 7	5 8	—	5 5	2 7	1 8	2 11
March	5 6	9 6	8 6	6 6	5 11	—	3 11	1 9	1 10	2 7
April	4 1	9 5	8 1	3 2	6 1	7 4	3 4	1 7	2 2	3 1
May	4 5	6 0	7 9	3 10	5 0	7 0	4 10	2 6	2 3	2 6
June	7 6	5 5	12 8	8 7	6 1	11 11	7 2	3 8	4 0	3 6
July	10 4	6 7	11 1	8 5	5 3	11 0	7 11	4 5	3 10	2 1
August	12 4	6 8	11 6	7 1	5 5	10 8	7 11	4 8	4 9	2 8

(a) Weights of bags vary, but on the average are approximately as follows: For cabbages: Johannesburg, 105 lb., Cape Town 105 lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 65 lb., and Durban 85 lb.

Average Prices of Oranges and Pawpaws

SEASON (1st April to 31st March).	ORANGES (Pocket).							PAWPAWS (Standard box).	
	Johannesburg.			Cape Town.		Durban.		Johannesburg.	
	N.M. Navels.	Other.		Navels.	Valencias.	Navels.	Valencias.	N.M.	Other.
		Navels.	Valencias.						
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 10	1 6	1 5	2 0	2 1	—	—	2 0	1 7
1940-41	1 9	1 7	1 6	1 11	1 10	2 4	2 1	2 2	1 9
1941-42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1942-43	2 4	2 6	3 1	1 11	3 9	2 8	2 11	2 7	2 1
1942—									
January	—	2 6	3 8	2 10	4 7	—	3 11	3 3	
February	—	3 11	4 5	4 7	6 10	3 9	5 8	6 4	2 1
March	—	3 7	2 11	6 6	5 10	4 3	5 6	4 1	3 3
April	2 1	2 0	1 10	3 4	5 0	3 4	2 6	4 0	3 1
May	2 4	2 3	2 1	2 3	2 3	2 6	1 2	3 8	3 1
June	2 3	2 3	1 9	2 1	—	2 6	1 11	2 11	3 1
July	2 5	2 5	1 11	2 1	—	2 8	1 0	2 8	2 5
August	2 11	2 8	2 3	3 0	2 4	3 6	2 4	2 2	1 8
September	2 5	3 3	2 3	3 4	2 2	4 0	2 6	2 1	1 6
October	2 9	2 11	2 7	5 1	3 1	3 7	2 11	2 4	1 9
November	—	3 6	4 0	6 11	3 7	4 6	3 6	3 1	2 6
December	—	3 1	3 8	2 11	4 3	—	4 2	3 5	2 1
1943—									
January	2 0	3 8	4 0	—	4 10	2 4	3 9	3 9	2 0
February	7 1	5 8	5 3	—	7 6	—	4 9	4 11	3 6
March	5 11	5 4	4 1	6 6	8 6	3 3	5 8	5 2	3 9
April	3 4	2 11	2 10	5 3	4 9	3 3	4 0	4 4	3 3
May	2 6	2 4	2 0	2 8	2 0	2 4	—	4 1	2 11
June	2 6	2 4	1 9	2 6	—	2 7	—	3 0	2 9
July	—	2 5	1 9	2 5	—	2 6	2 5	3 2	2 4
August	—	2 6	1 11	—	—	2 6	2 5	3 4	2 1

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

SEASON (1st July to 30th June).	EGGS. Johannesburg. New Laid, per dozen.	EGGS. Johannesburg. Fresh, per sozen.	EGGS. Cape Town, per 100.	EGGS. Durban New Laid, per dozen.	HIDES (per lb.). Port Elizabeth. 1st Grade, Sun-dried.	HIDES (per lb.). Port Elizabeth. 1st Grade, Dry Salted.	SKINS. Port Elizabeth. Merino. Medium, per lb.	SKINS. Port Elizabeth. Merino. Combings, per lb.	SKINS. Port Elizabeth. Glovers, Sound, per skin.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938-39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940-41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941-42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1942-43	1 10	1 6	13 5	2 0	7·8	8·2	5·7	9·5	3 5
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·5	9·7	3 4
1943—									
January	1 8	1 4	13 11	2 2	8·0	8·1	5·7	9·1	3 4
February	2 3	1 11	16 7	2 7	8·1	8·1	6·1	10·5	3 5
March	2 9	2 3	19 4	3 2	7·8	7·9	5·9	10·8	3 4
April	3 3	2 9	24 8	3 11	7·8	8·7	6·3	11·1	3 7
May	3 10	3 5	29 2	4 10	7·8	8·9	5·9	10·2	3 7
June	2 3	1 10	18 7	2 9	7·9	9·2	5·7	9·9	4 0
July	1 9	1 6	16 3	2 0	8·0	9·3	5·9	9·9	4 5
August	1 8	1 5	13 5	1 9	8·0	9·3	5·8	9·3	4 5

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

SEASON (1st July to 30th June).	GREEN BEANS (Pocket 20 lb.). Johannesburg.	GREEN BEANS (Pocket 20 lb.). Cape Town.	GREEN BEANS (Pocket 20 lb.). Durban.	GREEN PEAS (Pocket 20 lb.). Johannesburg.	GREEN PEAS (Pocket 20 lb.). Cape Town.	GREEN PEAS (Pocket 20 lb.). Durban.	CARROTS (Bag). (a) Johannesburg.	CARROTS (Bag). (a) Cape Town.	CARROTS (Bag). (a) Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 1
1940-41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	13 4
1941-42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942-43	3 1	4 3	3 0	3 3	2 10	3 9	5 1	8 9	13 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 6
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	19 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 6	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 9	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	6 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10
1943—									
January	1 9	3 3	3 5	2 4	6 9	4 7	3 9	5 1	11 3
February	2 5	4 4	3 10	4 8	5 9	5 1	6 0	6 5	11 4
March	2 8	3 1	1 6	6 7	4 5	3 10	7 9	4 0	19 1
April	2 0	2 2	2 3	5 1	3 0	2 8	8 1	6 10	23 11
May	2 11	4 11	2 11	5 11	4 8	5 2	8 5	11 1	16 10
June	6 5	4 0	4 7	6 5	5 1	9 3	9 1	13 4	18 7
July	9 0	10 1	7 2	4 6	5 9	5 10	11 9	16 1	17 10
August	5 2	6 11	6 11	4 10	5 4	4 7	13 3	14 6	21 0

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

Average Prices of Maize, Kaffir-corn and Dry Beans per 200 lb.

Season and Month.	Maize.					Kaffircorn F.o.r. Producers' Stations.		Dry Beans Johannesburg (Municipal Market).	
	F.o.r. Producers' Stations.				Cape Town Consumers' Price F.o.r. No. 6 in Bags.				
	No. 2.		No. 6.						
	Bags.	Ex Elevator.	Bags.	Ex Elevator.		Bags, K. 1.	Bags, K. 2.	Speckled Sugar.	Cow Peas
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	8 7	8 6	8 6	8 8	13 2	13 1	12 9	25 0	16 9
1940-41	9 2	8 8	9 3	8 9	14 0	15 6	17 0	30 0	16 8
1941-42	10 10	9 10	10 4	8 11	14 3	18 10	19 6	32 10	19 8
1942-43	15 1	—	15 1	—	18 1	24 10	24 10	34 0	25 8
1942—									
January	11 0	10 1	10 10	9 4	14 9	21 5	22 3	34 4	21 9
February	11 0	—	11 0	—	14 8	21 11	22 11	32 7	20 11
March	10 6	—	10 6	—	14 9	20 2	21 1	30 10	19 2
April	10 6	—	10 6	—	14 10	18 5	18 9	32 6	25 5
May	15 0	—	15 0	—	15 6	20 8	20 8	32 8	26 4
June	15 0	—	15 0	—	17 6	21 11	21 11	33 5	26 5
July	15 0	—	15 0	—	17 7	21 8	21 8	33 7	24 8
August	15 0	—	15 0	—	17 8	22 10	22 10	36 7	27 2
September	15 0	—	15 0	—	17 7	24 6	24 6	38 1	28 4
October	15 0	—	15 0	—	17 9	24 8	24 8	39 0	27 6
November	15 0	—	15 0	—	17 10	25 0	25 0	38 6	27 1
December	15 0	—	15 0	—	17 11½	25 0	25 0	37 3	22 7
1943—									
January	15 0	—	15 0	—	18 6	27 3	27 3	33 7	21 4
February	15 0	—	15 0	—	19 2	34 2	34 2	30 1	22 8
March	15 0	—	15 0	—	19 6	29 6	29 6	34 8	26 3
April	15 0	—	15 0	—	—	21 7	21 9	35 7	27 1
May	16 0	15 3	16 0	15 3	—	21 8	21 8	41 6	28 3
June	16 0	15 3	16 0	15 3	19 3	21 4	22 1	42 1	28 7
July	16 0	15 3	16 0	15 3	19 3	24 6	25 6	46 9	29 9
August	16 0	15 3	16 0	15 3	19 3	24 7	25 5	53 11	33 0

Seasonal year for maize and kaffircorn, 1st June–31st May; for dry beans, 1st April–31st March.

Average Prices of Apples, Pears and Grapes on Municipal Markets.

Season (1st July to 30th June).	Apples (Bushel box).						Pears (Bushel box).		Grapes (Tray).
	Johannesburg.			Cape Town.			Johannesburg.		Johannesburg.
	O'henimuri.	White Winter Pearmain.	Wemmershoek.	O'henimuri.	White Winter Pearmain.	Wemmershoek.	N.M. No. 1	Other.	Johannesburg.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	7 2	6 0	5 10	7 3	8 0	4 3	6 7	4 2	1 3
1940-41	8 4	7 1	6 4	8 11	10 8	5 [illegible]	8 11	6 3	1 8
1941-42	8 11	7 11	7 3	9 1	10 9	6 9	7 3	8 0	1 11
1942-43	14 9	11 6	9 1	10 8	12 11	6 11	—	10 8	1 10
1942—									
January	—	—	—	—	—	—	—	7 5	3 2
February	8 3	—	12 2	8 10	—	—	7 3	*7 8	1 6
March	7 5	6 11	7 6	7 7	9 3	6 3	5 6	7 0	1 10
April	8 6	7 6	6 8	7 9	9 8	6 2	—	9 6	1 11
May	8 10	7 7	6 5	8 9	9 7	5 6	—	8 11	2 0
June	10 1	8 10	8 4	8 7	10 9	6 3	—	15 9	2 5
July	11 2	11 4	8 1	10 10	12 1	8 11	—	—	0 10
August	17 6	15 8	10 6	11 7	11 8	9 10	—	—	—
September	16 4	16 3	7 0	11 11	11 3	—	—	—	—
October	16 6	16 3	—	9 11	9 4	—	—	—	—
November	20 8	18 6	—	10 4	7 2	—	—	—	—
December	19 7	17 8	—	11 10	17 5	—	—	14 10	3 8
1943—									
January	—	17 5	—	11 5	—	—	—	9 3	2 3
February	10 1	11 0	14 4	8 11	9 0	4 11	—	9 10	1 5
March	8 5	10 1	8 10	9 2	11 8	5 9	—	10 0	2 0
April	13 10	10 6	11 7	10 4	12 2	6 11	—	12 8	2 2
May	16 8	11 11	12 5	12 0	13 0	8 0	—	14 8	2 9
June	18 3	17 1	12 8	14 1	16 5	13 1	—	—	3 4
July	17 3	19 7	—	12 6	17 2	14 0	—	—	—
August	19 5	18 10	13 3	13 10	17 9	—	—	—	8 5

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Photo on Front Page by S.A.R. and H.

[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Horse Improvement Scheme "B" (Farmers).

SERVICE SEASON 1943–44.

During the service season 1 October 1943 to 15 January 1944, the following stallions will stand at stud for service of farmers' mares at the undermentioned Institutions:—

1. College of Agriculture, Grootfontein, Middelburg, C.P.: Percheron.
2. College of Agriculture, Glen, O.F.S.: Percheron and Thoroughbred.
3. College of Agriculture, Potchefstroom: Percheron, Thoroughbred and Donkey Jack.
4. College of Agriculture, Cedara, Natal: Percheron.
5. College of Agriculture, Stellenbosch-Elsenburg: Percheron.
6. Veterinary Research Station, Ermelo, Tvl.: Percheron and Thoroughbred.
7. Pretoria University, Pretoria: Percheron.
8. Dohne Experiment Station, P.O. Dohne: Percheron.
9. Oakdale School of Agriculture, P.O. Riversdale: Percheron.

The Pretoria University will accept a limited number of mares under Scheme B for the Percheron stallion maintained there. Only mares on heat will be accepted, and in no cases can they be kept longer than three days, at 1s. per day.

The main features of the Scheme are:—

(*a*) A dourine free certificate must be submitted with the application and farmers should have their mares tested early.
(*b*) Only halter-tame mares and jennies of approved type and in satisfactory condition will be accepted—mares standing 14 hands and over and jennies 13 hands and over.
(*c*) Railway charges are charged for the forward journey only.
(*d*) The service fee is £1. 1s. and maintenance costs are 2s. 6d. per week. An additional charge of 1s. per day is made for stabling if desired and available.

Full particulars of stallions and a copy of conditions of the Scheme are obtainable from every stud station.

Brine in Refrigerating Systems.

In view of the critical position in regard to Sodium and Calcium brines, and also in view of the need for reducing corrosion in refrigerating plants to a minimum, the Officer-in-Charge of Dehydration and Cold Storage, P.O. Box 3, Cape Town, has drawn up notes on the uses of brine in refrigerating plants, and methods of testing such brines.

Readers who are interested in the subject can apply to the above address for copies of the notes and also obtain particulars about advice and assistance on any problem connected with the use of brines.

New Bulletins for the Farmer.

The following Bulletins have just been published and are obtainable from The Editor, Department of Agriculture and Forestry, Pretoria.

Bulletin No. 192.—"Control of Household Insects in S.A." (2nd Edition): Price 6d.

Bulletin No. 111.—"Dairy Farming" (Fifth Edition): Price 6d.

Bulletin No. 126—"Poultry Houses": Price 3d.

FARMING IN SOUTH ...AFRICA

Vol. 18 NOVEMBER 1943 No. 212

Editorial:

Production of Pasture Crop Seed.

THE importance of good pasture crops is fully realized by most farmers to-day, and the natural grazing continues to be an immense resource, particularly when judiciously utilized. Most of us know that there is hardly a part of the country where it is not possible, and indeed essential, to supplement or improve the natural grazing. One of the most practical means to this end is the planting of hay and pasture crops, by far the most important of these being grasses and legumes. It is not only interesting but also surprising to see what some of our enterprising farmers have achieved in this direction and the extent to which such crops are now being utilized.

Winter Pasture Crops.—Changed circumstances have made it necessary for us to devote attention to the production of those pasture-crop seeds which were formerly imported. Fortunately there are farmers who are prepared to go in for seed production, an undertaking which has been very much neglected in the past, but which deserves to occupy and will certainly occupy a more prominent place in our agricultural industry. This undertaking is strongly recommended, not only in view of prevailing conditions, but also because it will prove highly remunerative if tackled in the proper manner. An important consideration is also the fact that the results obtained from seed produced in the country or area in which it is cultivated are usually better than those obtained from imported seed. The production of our own seed requirements would therefore inevitably raise the level of production.

Summer Grasses.—Up to the present no difficulty has been experienced in connection with the cultivation of the above-mentioned crops, since it has always been possible to obtain seed commercially. This, however, does not apply to our indigenous grasses, which up to the present have been grown almost exclusively from roots or shoots, with the result that progress has been considerably hampered. It is felt that something should be done to enable farmers to obtain the required grasses, and in a more acceptable form at that. It is with this in mind, therefore, that the attention of farmers is drawn to a scheme which aims at making available to all the seeds of good African summer grasses which also set seed satisfactorily.

Scheme for making Grass Seed Available.—Under this scheme the Department will, through the medium of the Division of Soil and Veld Conservation, issue seed or plant material of good and promising grasses free of charge to farmers who are prepared to cultivate and propagate them with a view to seed production. It will be necessary in the farmer's own interests to give these crops the correct treatment and to utilize the best soil only, so as to avoid any unnecessary disappointments and failures. Since the available seed or plant material is very limited, the farmer will, of course, have to increase the grass to the desired acreage for one

or more years with his own seed or plant material. This acreage will depend upon the requirements of the farmer who will possibly also have to take into account the future demand, but it may be stated that a larger acreage will prove more remunerative than a very small acreage. If farmers make a success of the undertaking, they will immediately create their own market, since other farmers in the neighbourhood will undoubtedly also wish to plant the grass. This in turn will create possibilities for the establishment of local seed associations—a highly desirable development. Another essential will be to take the necessary precautions for ensuring that the grass varieties remain true to type. For this a certain amount of isolation will be necessary if other related varieties are grown in the neighbourhood.

The institution of a form of control for the protection of *bona fide* seed-growers will also be necessary, and this will necessitate registration, inspection and certification. All yields, of whatever nature, will be the farmer's property. Prices for seed may be fixed in consultation with the Division, with due regard to the ruling prices of similar seed. Since the realization of this object would be greatly facilitated by the co-operation of farmers, an appeal is made to all who are interested in the undertaking to participate in the scheme. There is no reason why South Africa should lag behind other countries in this respect. All that is necessary is that farmers should tackle the undertaking seriously and carry it through to success.

The grasses available for this purpose include the best seed-setting varieties and the most promising from all groups, as for example, the digitarias, buffalo-grasses, wild manna grasses, etc. Further information in regard to these groups will perhaps be furnished at a later date. In the meantime particulars regarding this scheme are obtainable from the Chief, Division of Soil and Veld Conservation, P.O. Box 965, Pretoria.

[L. C. C. Liebenberg, Professional Officer (Grass-seed Research), Division of Soil and Veld Conservation.]

A Bulletin on Poultry Farming.

THERE has been such a great increase in the demand for literature on poultry farming during the past few years that almost all bulletins on the various aspects of this subject have been sold out. Dr. J. J. Bronkhorst, Senior Poultry Officer, Division of Animal and Crop Production, has therefore written a detailed bulletin on poultry farming which has just been published as Bulletin No. 241. In this bulletin the author has endeavoured to review the various branches of poultry farming. Owing to the shortage of paper the bulletin is naturally very compact and no information on the housing of laying hens and the preparation of table birds is given, as these subjects are dealt with in bulletins Nos. 126 and 190 respectively.

Subjects discussed are: poultry farming in South Africa; artificial incubation of eggs; rearing of chicks; the significance of the rôle played by feeding; judging fowls for egg-production; the mating and breeding of fowls; the marketing of eggs; the most important poultry diseases; the economic aspect of poultry breeding, and factors to be considered in laying out a poultry farm.

The bulletin contains 69 illustrations, covers 100 pages and is obtainable from the Editor of Publications, Department of Agriculture and Forestry, Pretoria, at 1s. per copy.

Harmful Insects in Stored Winter Cereals.

Dr. J. T. Potgieter, Professor of Entomology, Stellenbosch-Elsenburg College of Agriculture, University of Stellenbosch.

WHEAT and other winter cereals which are stored, are subject to attack by various harmful insects. Sound grain is attacked by two species of weevils, a bostrychid beetle and the Angumois grain moth. There are, however, other insects which can continue the damage to grain once this has been started.

Since these insects cause great damage to stored grain every year, it is essential that every farmer should be acquainted with their

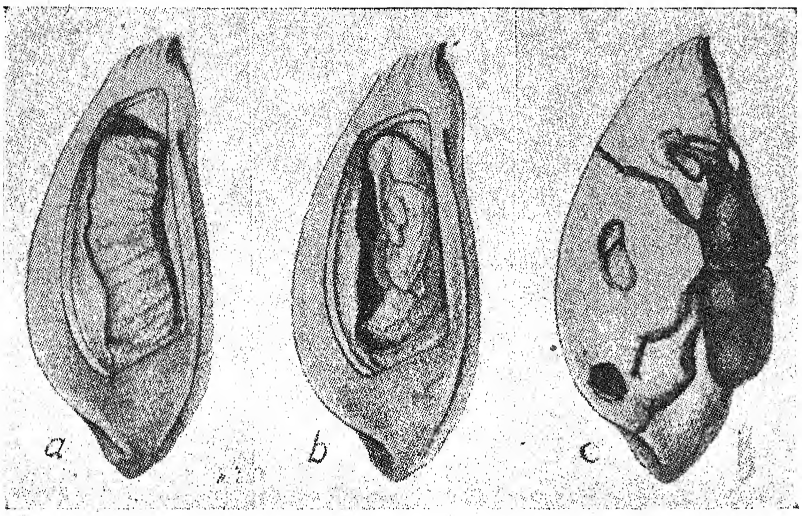

FIG. 1.—The rice or black weevil: (a) an almost full-grown larva; (b) pupal stage; (c) adult insect feeding.

habits and the control measures which may be applied. Grain insects multiply very rapidly under favourable conditions especially if the climate is hot and the grain moist. Under normal conditions grain is seldom too dry for the development of these insects, but the lower the moisture content of stored grain, the less liable is the product to be attacked by weevils and other insects.

The weevils which make the primary attack on grain are the rice or black weevil, *Calandra* (Sitophilus) *oryzae* L., and the granary weevil, *Calandra* (Sitophilus) *granaria* L. These two weevils not only feed on all kinds of grain, but also multiply in it. In the absence of grain they can also subsist on other stored food products. The damage done to grain and other products by feeding alone is often of a very serious nature when weevil infestation is severe.

The Black Weevil.

In many parts of the world the rice or black weevil (*C. oryzae*, Fig. 1*) is regarded as the most harmful pest of stored grain. It attacks not only all kinds of winter cereals, but also maize and rice.

* All Photos taken from U.S.D.A. Farm Bulletin 1260.

It is a small dark-brown or black weevil about ⅛ inch long and can fly from one place to another. Its mouth parts are attached to a thin cylindrical snout which is about ¾ the length of the thorax. The thorax is longer than broad, and is covered with deep, rough punctures. The anterior wings (elytra) which shield the rest of the body are deeply ribbed in their length, and also covered with rough spots. On each anterior wing there are two light-red spots by which this species may readily be distinguished from the granary weevil. After having eaten out a cavity in the grain kernel, the female deposits a single egg which is covered with a gummy fluid, so that the egg cannot be seen. The egg hatches after 3 to 5 days and the legless larva, which emerges, feeds and lives inside the grain kernel without ever leaving it. After 2 to 3 weeks the larva is full grown, and then pupates inside the kernel; at this stage the snout, legs, antennae and wing buds are clearly visible in the pupa. After about a week the adult insect emerges after having bored its way out through the testa of the hollowed-out grain seed, and, if it is a

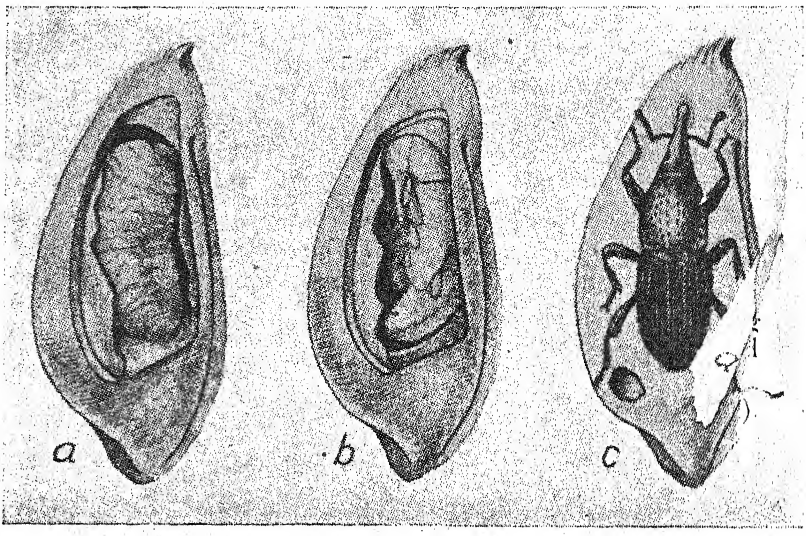

FIG. 2.—The granary weevil: (*a*) larva; (*b*) pupa; (*c*) adult stage.

female, commences the cycle again by laying her eggs in sound grain. The adult weevil lives for four to five months, during which time it lays from 300 to 400 eggs. In summer it takes the insect about a month to complete its life cycle and in winter a little longer. Several generations of these weevils, therefore, occur during one year, and a single female is capable of producing a very large number of weevils and can consequently cause a serious infestation in grain during the period in which this product is normally stored.

The Granary Weevil.

The granary weevil (*C. granaria*, Fig 2) was the first grain-destroying weevil to be described and has a world-wide distribution. This insect is about $^3/_{16}$ inch long, dark-brown in colour, and slightly smoother than the rice weevil but lacks the spots on the anterior wings, and is also incapable of flight. The adult female lives from 7 to 8 months during which time she lays several hundred eggs. The

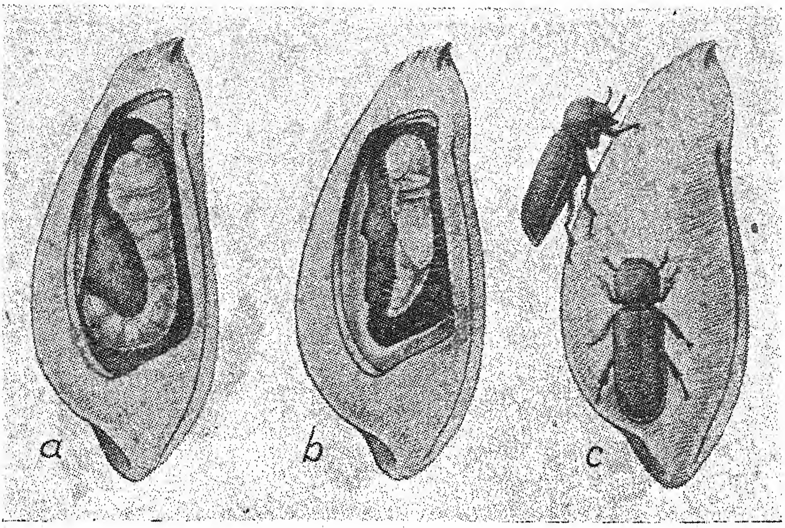

FIG. 3.—The Bostrychid grain beetle: (*a*) larva; (*b*) pupa; (*c*) beetles.

manner of oviposition, as well as the subsequent development of the insect, closely resembles that of the rice weevil. In contrast to the rice weevil, however, the granary weevil does not multiply in the field, and is usually found only in places where grain is stored.

The Grain Beetle.

The bostrychid grain beetle *Rhizopertha dominica* F. (Fig. 3), also known as the Australian grain beetle, is one of the smaller species of beetles which attack sound grain and can cause considerable damage. They are already found in large numbers in all parts of the country, especially in mills where they can also live on and breed in the meal.

This beetle is dark-brown in colour with a rough surface, and is a strong flier. It can readily be distinguished from other grain

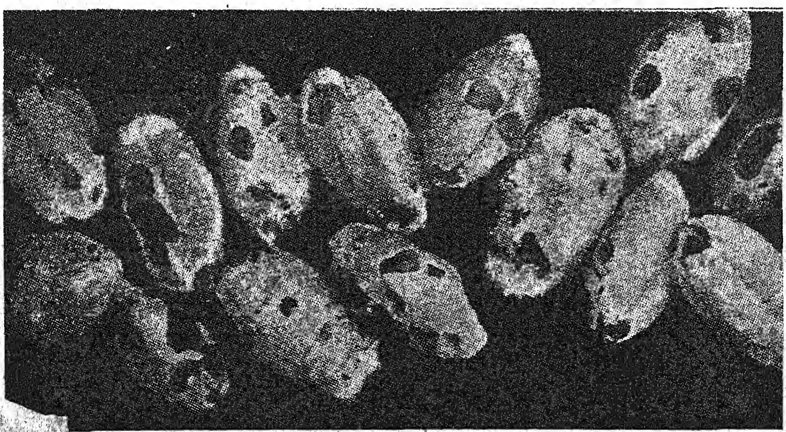

FIG. [illegible]—Wheat kernels damaged by Bostrichid grain beetles and their larvae.

destroyers by its size and structure. It is about $\frac{1}{8}$ inch long and $^1/_{32}$ inch broad, cylindrical in shape, the head folding in under the thorax, and is provided with strong jaws with which it can bite even into wood or other material.

The female lays from 300 to 400 eggs, singly or in groups, among the grain. Small white larvae hatch from the eggs. They crawl about actively and feed on the remains of grain kernels which have already been attacked by the adult beetles or damaged in some other way. Another characteristic of these larvae is that they also bore holes into slightly damaged grain kernels. The adult beetles also

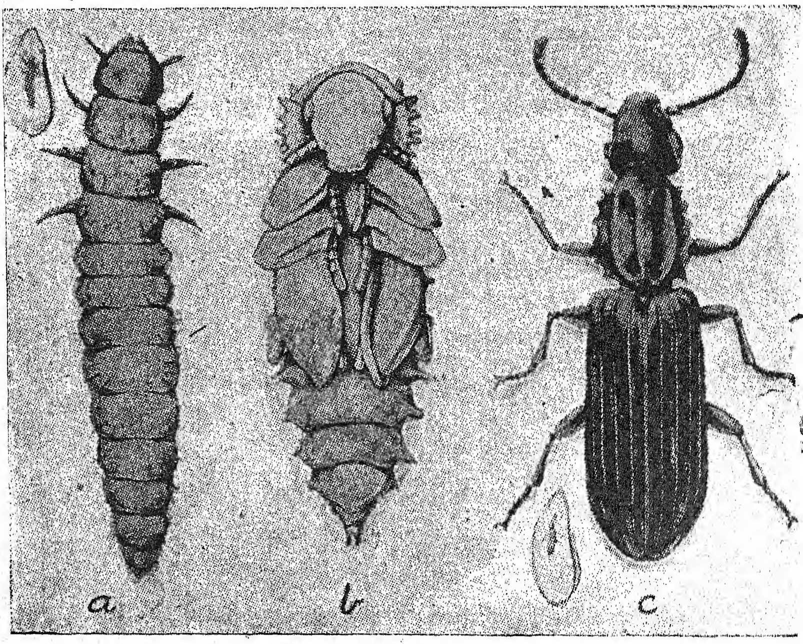

FIG. 5.—The saw-toothed grain beetle: (a) larva; (b) pupa; (c) adult stage.

bore holes into sound grain seeds and together with the larvae completely hollow out the seed until only the empty shell remains (Fig. 4). In summer this insect takes about a month to complete its life cycle. After grain has been attacked by one of the primary insects, or damaged in some other way, the damage may be continued by other species of beetles of which the saw-toothed grain beetle, *Oryzaephilus surinamensis* L, the two flour beetles, *Tribolium confusum* Duv. and *Tribolium castaneum* Hbst., the small flat grain beetle, *Laemophloeus minutus* Ol., and the Cadelle, *Tenebrioides mauritanicus* L., are the most important.

Although all these beetles and their larvae feed only on damaged kernels and other particles of refuse, and cannot live on or develop in sound grain, some of them are usually present in large numbers in grain stores and mills where they often do much more harm to already damaged grain kernels than is generally realized. Consequently the control of these insects must not be neglected.

The Saw-toothed Grain Beetle.

The saw-toothed grain beetle (*O. surinamensis*, Fig. 5) is a very active small flat beetle about $^1/_{12}$ to $^1/_5$ inch long, with a narrow dark-brown body. It can readly be distinguished by its thorax which is longer than it is broad and on each side of which there is a serrated edge with 6 teeth. It is to these saw-like points that the insect owes its name. This beetle is usually present in large numbers wherever grain is stored. In the adult stage it lives from 6 to 10 months during which period the female lays her eggs singly among the damaged grain kernels and the small flat larvae which emerge, crawl over and feed on this grain and in summer are full-grown after about 2 weeks. The full-grown larva now spins a thin cocoon-like covering which contains small pieces of grain and other particles of food, and in which it pupates. The pupal stage lasts about one week. In summer the whole life cycle can, therefore be completed within three to four weeks.

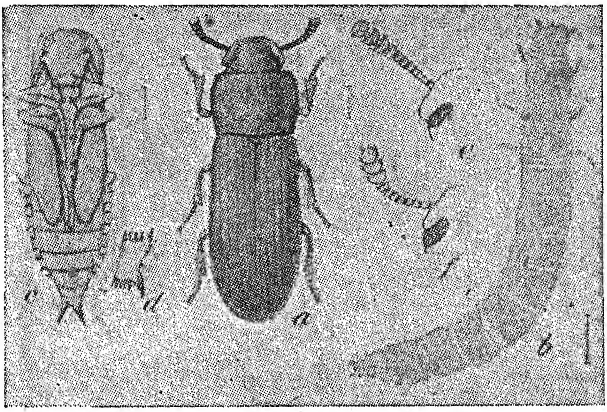

FIG. 6.—The flour beetle *T. confusum*: (*a*) beetle; (*b*) larva; (*c*) pupa; (*d*) lateral lobe on abdomen of pupa; (*e*) antenna; (*f*) antenna of *T. castaneum*.

The Flour Beetles.

The flour beetles (*T. confusum* and *T. castaneum*, Fig. 6) are commonly found on damaged grain and are particularly troublesome in mills. They are reddish-brown in colour and vary considerably in size, namely, from $^1/_{16}$ to $^1/_7$ of an inch in length. The two species generally encountered here are difficult to distinguish from each other with the naked eye. For a long time *confusum* was confused with *castaneum;* hence the specific name for the former species. They can be distinguished from each other, however, by the structure of the knobbed antennae; in the case of *confusum* the segments gradually increase in size, whereas in the case of *castaneum* the last three segments are definitely larger than the anterior ones. The head and thorax are punctate, i.e., covered with fine spots. The anterior wings are ribbed in their length and slightly dotted.

The life cycle and habits of these two beetles are very similar. The females live for a year or even longer, and lay from 400 to 500 eggs. The eggs are laid singly on the grain or other food material, or even in cracks and crevices. The eggs are covered with a gummy secretion which permits of their being readily attached to all kinds of objects. Containers and storerooms must, therefore, be disinfected before sound grain or grain products are again placed or stored in them. From the small white egg there emerges a larva with a thin,

cylindrical thread-like appearance. The larvae have a yellowish-white colour and are roughly $^3/_{16}$ inch long when full-grown. They feed on meal or particles of grain and change into a small unprotected pupa which is white at first and later becomes brown. From this the adult beetle emerges and during summer the whole cycle can be completed within a month.

The Small Flat Grain Beetle.

The small flat grain beetle (*L. minutus*, Fig. 7) is also commonly found in grain stores and mills, and is one of the smallest species of beetle living and breeding on damaged grain. It is generally encountered in large numbers together with the rice weevil. It is more of a scavenging beetle, giving preference to bad grain or meal. The insect is dark-red in colour, about $^1/_{16}$ inch long with elongated antennae which are almost ⅔ the length of the body. The larvae hatching from the eggs which are laid singly, have a predilection for the germ of the grain kernel and frequently this is the only part of the seed which is damaged. This insect takes from 5 to 9 weeks in summer to complete its life cycle.

FIG. 7.—The small flat grain beetle (*L. Minutus*).

The Cadelle "Grain Worm".

The Cadelle (*T. mauritanicus*, Fig. 8) is a glossy, dark-brown beetle which is much larger than all the other grain beetles and about ⅜ inch long. The head and prothorax are punctate. The anterior wings are ribbed in their length a[illegible] also spotted. The beetle has a flat structure and is of widespread [illegible]currence in stored grain. The larva of this species is very conspi[illegible]ous with its black head, three p[illegible]irs of strong legs attached to t[illegible]e thorax, and a dirty white or light-red coloured body with short prickles along the sides and two black chitinous or horny hooks at the end of the abdomen (Fig. 9). It is about ¾ inch long when full-grown and is commonly known as a "grain worm". The worms have the bad habit of crawling into articles of fu[illegible]niture, and other crannies in [illegible] house if infested grain is s[illegible]ed in the loft. In the case of [illegible]is species the female lays up to 1,000 eggs and the development from the egg to the adult stage takes about 70 days or longer in summer. The adult insect generally lives for about a year and may sometimes even survive for about two years.

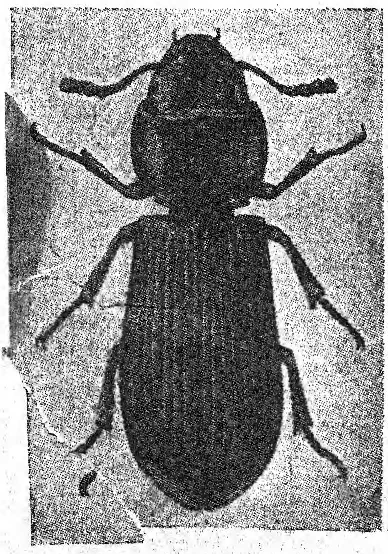

FIG. [illegible].—The Cadelle.

The Grain Moth.

The Angumois grain moth, *Sitotroga cerealla* Ol. (Fig. 10) is the most important species of moth which attacks grain and its distribution is world-wide. These moths attack even growing grain on the land and later the eggs are laid on the ripening ears. In the storeroom the eggs are laid either on or near the grain. The female moth lays an average of 50 to 100 eggs during her life. On hatching from the eggs the larva bores its way into the kernel in such a way that the point of entry is invisible to the naked eye. The larva feeds inside the grain kernel until it is full-grown when it is nearly as long as the seed. It then pupates inside the seed, and finally the adult moth emerges through a hole in the empty shell which the larva makes before it pupates. In summer the life cycle is completed within 30 to 80 days. The moth is a dull grey coloured insect with a wing-span of about ½ inch.

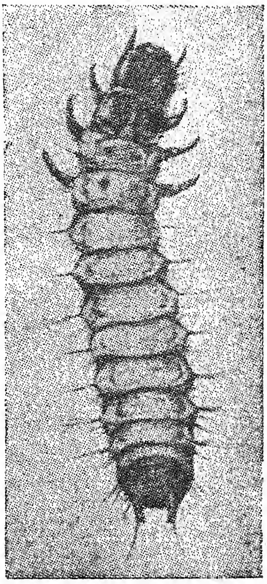

FIG. 9.—A full-grown larva of the Cadelle.

This moth is very common in grain sheds and in mills. The damage caused by the larvae of the moth will, therefore, not be readily confused with that caused by other flour moths, since the larvae of this species of moth generally attacks only damaged grain, and develops on undamaged grain kernels only under very favourable conditions. When they do establish themselves on sound seeds, however, they generally destroy only the germ, as is particularly the case with the Indian meal moth, *Plodia interpunctella* Hb. Two other flour moths included in this group are the Mediterranean flour moth, *Ephestia kuehniella* Zell. and the flour snout moth, *Pyralis farinalis* L. These flour moths lay their eggs anywhere near the grain, and the larvae which emerge are superficial feeders. They leave a web of silky threads in the grain wherever they move, and later they also spin a web of silken threads and food particles by which their presence can readily be detected. The pupal stage is spent in a silky cocoon out of which the adult moth eventually emerges.

Control Measures.

It is, therefore, almost wholly impossible for grain to remain completely undamaged, since the weevils, especially the rice weevil and the Angumois grain moth, can infest it while it is still on the land. The attack is then continued in the storeroom and the infestation may not be observed before the adult insects emerge from the hollowed-out grains. For the rest of the year and even during the winter, these insects continue to breed on the stored grain and are then usually still present as adult insects when the new crop is harvested. For this reason it is absolutely essential that all places where grain is stored should be very thoroughly sprayed with a paraffin-soap-emulsion before the new crop is stored in them. Twenty gallons of the spray are prepared as follows:—One pound of hard soap is first cut up in two gallons of boiling water which is continually stirred until the soap has dissolved. Remove the solution from

the fire and then add four gallons of paraffin and stir the mixture thoroughly until it forms an emulsion which is then further diluted by the addition of 14 gallons of water and again stirred well.

When the shed or storeroom is sprayed, special care must be taken to ensure that all cracks in the floors, walls or woodwork are thoroughly wetted with the spray. This emulsion is a contact insecticide and the entire surface of the shed must, therefore, be very thoroughly wetted with it, so that every possible place harbouring the grain insects can be reached. After the application of this spray the storeroom must be swept clean, and all the dirt collected and burned.

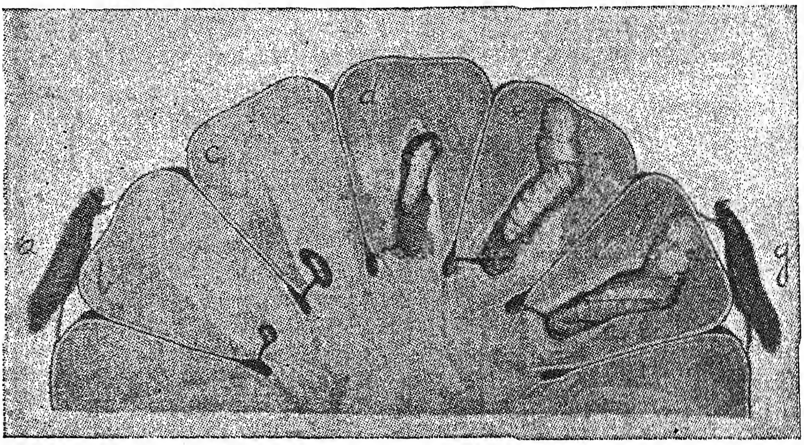

FIG. 10.—The development of the Angumois grain moth in a maize ear: (a) and (g) moths; (b), (c) (d), (e) different larval stages; (f) pupal stage.

Another precautionary measure is to ensure that grain is n threshed on the same spot every year since stacks of old chaff off ideal harbourage for the primary grain insects which may caus re-infestation. Another point is that the grain must be quite ripe and as dry as possible before being threshed and stored, since damaged and moist grain is much more likely to be attacked by these insects.

If old bags are used again for the new crop, they must first be thoroughly disinfected by fumigating them with carbon bisulphide to make certain that they are not harbouring any grain insects.

Grain which is kept exclusively for seed purposes can be safeguarded against insect damage by storing it in an air-tight containe when quite dry, and by sprinkling a small quantity of paradichloro benzene crystals over it, and by repeating this treatment later on when the crystals have been almost completely volatilized. Such grain may not be used for consumption purposes because the crystals impart a strong peculiar taste to the grain which cannot be readily removed. If such grain is fed to animals like cows or fowls the milk or the eggs will be tainted.

Fumigation of Grain.

Infested grain is fumigated with carbon bisulphide. Use 8 lb. or 5 pints of liquid for every 1,000 cubic feet of the total volume of an air-tight tank, bin or storeroom. If the container cannot be made quite air-tight, more carbon bisulphide must be used. Furthermore,

 [Continued on page 818.

Hints on Crop Production.

Dr. J. Fisher, Principal, College of Agriculture, Cedara.

Ploughing.

THE following general hints may be of use to the farmer:—

Ploughing should be on the contour, if practically possible. There should be no rushing or skimping of the work of soil preparation for the crop. The shape and lenght of fields for tractor work, for oxen, horses, etc., should first be considered, as certain proportions in fields are desirable. For tractor work and ploughing with oxen the fields should be several times as long as they are broad, and rectangular rather than irregular in shape so that there shall be no short furrows or cuts. It is very inefficient work for ploughs to finish off short furrows in the middle of a newly ploughed field, with oxen turning and turning on the newly ploughed land.

A good practice is to leave the width of the turning headland at each end of the field and along both sides of the field also, so that when the headlands are to be ploughed, the ploughs can go right round the field, ploughing all the way and finishing at the gate. All this round the field ploughing will gather the ploughed land into the field and will not throw it out as is done so often. Occasionally the direction of the ploughing of the headlands and the field should be reversed, i.e., what has been "gathered" should be "thrown out", and vice versa. This keeps the "lands" level and free from dead furrows which often tend to become erosion furrows. The corners, where the ox ploughs cannot get at, can easily be finished with a pair of horses and a single-furrow plough. If these corners, headlands and sides of the fields are not attended to they just grow weeds which seed into the lands.

The headlands and field sides are also the sources from which invasion of pastures by pioneer species of grass takes place.

The width required for a mowing machine and pair of horses can be left right around the field, free from crop; and once or twice a year the machine can be run round the field. This stops all seeding of weeds, such as black jack, nicandra, khaki-bos, etc., and allows the farmer to see his crop much better, and forms the fire break where this is necessary.

Ploughs must be properly set and oxen properly yoked so that the front mould board of a multiple-furrow plough does its full width of ploughing.

On the light soils, and particularly at the present time, care should be taken not to plough too deep. There is a shortage of fertilizers and it is a serious mistake to dilute the top soil with inferior subsoil, which is nowhere nearly as valuable for crop production, being deficient in bacterial life and plant food as well. It is obvious that there hould be no missed furrows to endanger all subsequent operations. Ploughs must be cleared if and when they clog on the surface due to grass, stubble, weeds, etc., and the same remark applies to the harrows and particularly the zig-zag harrows.

When fertilizer is to be distributed, there always tends to be a more liberal application near the gate, and more at the commencement of the round than later on. This results in uneven growth, eve lodging in places, whilst in other sections there is a sickly st ved appearance.

Seeding.

The reason for the use of only the best seed is obvious, but many farmers seem to think that seed grown by others is superior to seed grown by themselves. There is no reason why this should be so, as the local product should posses the definite advantage of being truly acclimatised. If the farmer pays some attention to the eradication of "bolters" in his cruciferous crops, and to rogueing of other crops he will soon find that he is growing seed equal to that which can be bought, and being home-grown it is also cheaper and he need not fear occasionally taking a chance with a catch crop because he has the seed on hand.

There is much local knowledge of the results of planting at different times, and such points as the following should receive consideration: Late plantings of maize are often seriously affected with streak, and liable to frost. Certain times of sowing teff entail serious problems with hay making later on. Soy beans should not be planted when the soil is cold, as germination is retarded, and they will be ready for hay making when the rainy season is still on. A mangel crop planted February-March at this institution failed to produce any seed in 15 months, though a portion of the crop was left for seed purposes.

In the past few years there has developed on certain farms a system of planting maize double-width rows, i.e., 7 ft. 6 in. apart. The reasons advanced for this are that it allows other crops to be grown in between these rows, such as Italian rye grass, soy beans, chou moellier, etc., also a restorative crop (soy beans, etc.) which occupy the soil after the maize has been reaped. There is less hand hoeing; less time in cultivations, as the space between the wide rows (i.e., double space) can be cultivated in the same time as half the space. With soy beans interplanted, two crops a year are secured; with rye grass three crops in two years. This system keeps the ground better covered and tends to lessen erosion as a result.

The earlier the row cultivation to kill the weeds near the line of young mealies the better, and the less work in the end. The sowing of Italian rye grass between wide-spaced maize is the equivalent of strip cropping. Wide rows allow cultivating implements to be fully opened up and hence double areas can be cultivated. When good cultivating weather comes along this means keeping lands free of weeds until other crops are sown or planted. Lands soon become singularly free from weeds under such a regime.

Crops and Acid Conditions.

Certain soils have acid or very acid reactions, and some crops are not at home under these very sour conditions. The crops which can be grown on acid soils are potatoes, maize, oats, grasses; on less acid soils: clovers and roots, except mangolds. The latter require an almost neutral soil, as seedlings fail to establish on very sour soils, though the seeds may germinate quite well. The obvious remedy is a fairly stiff dose of lime: 3-5 tons per acre if the mangold crop warrants this expenditure. It is better that this liming should be done the year before the mangolds are to be sown. When the soil is in good moisture content, mangold seed may be soaked for 24 hours before sowing, being well firmed into the soil when sown.

Pastures.

These prefer a dripping climate; this means that the atmosphere is often almost saturated. Grasses in particular like this sort of

climate. Lucerne, not a pasture plant, prefers a dry atmosphere and its water supplied by irrigation.

Pastures make very different demands upon the plant food of the soil than cereals do. Intensive pastures are balanced only with intensive stock, such as dairy cows, mares with foals at foot, ewes with lambs, etc. These animals all remove milk from the pastures and hereby removes three times as much nitrogen as it does of phosphoric acid. In order to meet these needs considerable quantities of nitrogenous fertilizers are used or the pasture must contain a good percentage of well inoculated clovers. This point must be emphasized. Clovers cannot compete with grasses for the nitrogen of the soil unless they are well inoculated. Clover seed should be thoroughly coated with the right organisms to produce the nodules and so render the clover plant totally independent of added nitrogenous fertilizers. This is the cheapest way of fertilizing pastures with nitrogenous fertilizers.

Fertilizing the Crops.

Recent investigations show that the application of the fertilizer in strips alongside the seed rather than putting the seed in the middle of the fertilizer, or broadcasting the fertilizer is the better practice. This particularly applies to soils rich in iron.

It is common practice when planting root seeds, i.e., swedes, turnips, chou moellier, to mix the seed with the fertilizer. The quantity of seed per morgen is mixed with the fertilizer per morgen, *but only as much of the mixture as can be planted in 2 hours.* If large quantities are mixed the germination capacity of the seed is likely to be harmed or even destroyed. Superphosphate is very harmful in this connection.

Pastures can be, and usually are, top-dressed by broadcast fertilizer machines when the grass on the pastures is dry. Fertilizing on wet days results in the fertilizer clogging in the machines and burning the herbage. The valuable portions of the fertilizer are all soluble and are readily dissolved into the soil with the rain. Good pastures may receive up to 1 ton fertilizer per morgen per annum when grazed by high yielding dairy cows.

Use of the Crops.

In many cases the handling of the crops is also very important. Where crops can be grazed off by stock they should be included in the cropping system. It is much cheaper and equally good farming to graze off rape, turnips, swedes, etc., than to have to pull, cut, cart and feed them and then to cart all the dung away. When grazed off the dung and urine are returned direct to the soil. This grazing should be controlled, of course, and can be very well accomplished by means of an electric fence.

Stock should never be allowed to foul far more food than they eat. After filling themselves, or consuming their allotted allowance, stock should always be returned to some neutral paddock to digest their ration.

Mangolds are one of the crops that are best carted and fed. Rape should be ready for grazing 12 weeks after sowing, provided conditions are good. Whilst swedes, turnips and kale are late summer or autumn planted, mangolds can be spring sown.

Crops to Grow.

Farmers must determine what crops they require. Very many wish to have better grazing in the middle of the summer and the

beginning of autumn than the veld can provide. This better grazing can be secured by growing a pasture like paspalum. This can be spring sown provided the farmer is prepared to use his mowing machine frequently if this should be necessary in order to control weed growth. Grazing can take place on paspalum the same autumn that it is spring sown. Grazing gives a better sward than allowing the grass to grow tall enough to cut for hay. Hay crops result in a thinning of the sward, whilst pasturing and the use of the mower to remove clumps which the stock wont graze, result in a denser closer sward which is one of the considerate.

Leguminous crops must bulk much more largely in all our cropping systems. Soy beans for sour veld, cow-peas for sweet veld for hay or grain, and sunn hemp for green manuring, must be increased several times over. They are restorative crops. They have much more protein than a cereal crop can ever have, and with a short supply of protein at present, any crops which contain good quantities of this should be grown, and if well inoculated, they enrich the soil in nitrogen also. Several small areas of soy beans can be sown to be grazed off in the autumn, and so save the expense still further of cutting all the crops and making them into hay. This grazing can be planned to combat the fall in the yield of the milk at this time of the year.

Drain the Wet Spots.

Many of our most valuable areas are the vleis. In the summer season there are low spots which are always waterlogged, and prevent the proper cultivation and cropping of the whole area. The field may have to be left until the wet spots are dry when the other parts of the field are too dry to plough. Hence there is no efficiency. These wet spots must be drained. The only object is to lower the water in these spots to below the cultivable level and not to lower the water table through the whole field. Concrete tiles in sour soils have a life of 20 years, burnt earthenware tiles are almost everlasting and these should be used. Small bore drains are of little value. Always use a larger (4 in.) tile. Your field will be ready for the plough all the sooner.

Sale of Blowfly Spray.

The Onderstepoort Blowfly Spray is now obtainable from Dealers and Co-operative Stores, at 4s. per gallon.

Farmers must provide clean and air-tight containers.

Dealers can obtain the blowfly spray from Onderstepoort or its substations at 3s. 6d. per gallon (in large drums).

Full particulars obtainable from Director of Veterinary Services, Onderstepoort.

Popular Bulletins.

(1) Calf Rearing—Bulletin No. 224. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

(2) The Export of Fresh Grapes from the Union of South Africa during the Ten-year period, 1930-39—Bulletin No. 225. Price 6d. Obtainable from the Chief, Division of Horticulture, Pretoria.

(3) Soft Cheese as a Food—Bulletin No. 229. Price 3d. Obtainable from the Editor, Department of Agriculture and Forestry, Pretoria.

Studies on Merino Wool Production.

Fleece Tests on Stud Sheep.

Dr. V. Bosman, Sheep and Wool Research Laboratories, Onderstepoort.

WOOL-PRODUCTION tests were begun at the Onderstepoort Sheep and Wool Research Laboratories ten years ago, and since then numerous fleeces from different merino studs and from different wool-growing areas have been tested.

This testing service, which has been made available to sheep breeders, has supplied them with reliable fleece analyses and, in addition, has been a source for material and information which, from the research point of view, has been of immense value.

The material has been used for demonstrating several fundamental points in merino-stud fleece production, and the fleece tests have also shown possibilities for advancing and applying merino recording.

Some aspects are discussed here.*

Quantity of Wool from Stud Sheep.

Since the merino is primarily a wool-producing sheep, its fleece as quantity of wool is, from the stud breeder's point of view, of considerable importance. (It must be remembered that the progeny of stud sheep are used for improving the general flock sheep and ultimately the wool clip.)

It has been shown that a reliable measure of wool production must preferably be based on the clean-wool content rather than on the greasy fleece, and in this connection it has been observed that the human estimate of quantity of wool, when judged on the sheep by methods of hand and eye, is unreliable. For this reason the testing of stud fleeces on a large-scale routine basis has been developed and made available to sheep breeders.

These tests have shown the standards of production that are in existence among stud animals and have given information on the question often asked as to what constitutes stud production. The tests have also shown the possibility for a classification into high and low stud wool producers which point is often closely associated with high and low prices among stud animals (other things being comparable regarding the recognized merino characteristics).

An attempt to classify the merino fleece on quantity of wool alone would have its limitations, and for this reason the study is closely associated with other fleece characteristics which determine the nature of the fleece. In summarising the different quantities of wool obtainable from stud animals, their relationship with the different fleece characteristics are therefore also given.

Stud Rams.

The wool production of adult rams (" flock " and " stud ") for a twelve-month's growth, ranged from about 15 to 40 lb. in the grease, and from 7 to 16 lb. as clean wool (bone dry).

* The Recording of Merino Sheep—Research points the way to Establishing a Sound System—V. Bosman, *Farming in South Africa*, Sept. 1936. Reprints are obtainable from the Director of Veterinary Services, Onderstepoort, Pretoria.

It has been shown* that the quantity of wool produced is dependent on the wool length, the fleece density, the fibre fineness and the skin area of the sheep, and the different fleece weights for rams, theoretically calculated, are given in Table 1 in association with these characteristics. For simplicity of comparison, a type of stud ram which is well-grown, with a skin area of 15 square feet and a body weight of about 150 to 170 lb., has been taken.

TABLE 1.—*The wool production in relation to the fleece characteristics of stud rams that have a skin area of* 15 *square feet.* (*Theoretically calculated.*)

Fleece density as per cent. skin area occupied by wool fibres. (1)	Clean weight of fleece, in lb. (bone dry) for different staple lengths. (2)				Number of fibres growing per square inch of skin for fleeces of different quality numbers according to fibre fineness.				
	2½ in.	3 in.	3½ in.	4 in.	70's.	66's.	64's.	60's.	58's.
1·6	5·0	6·0	7·0	8·0	39,000	35,000	31,000	27,000	22,000
1·8	5·6	6·7	7·8	9·0	44,000	39,000	35,000	30,000	25,000
2·0	6·2	7·5	8·7	10·0	49,000	43,000	39,000	33,000	28,000
2·2	6·9	8·2	9·6	11·0	53,000	48,000	42,000	37,000	31,000
2·4	7·5	9·0	10·5	12·0	58,000	52,000	46,000	40,000	34,000
2·6	8·1	9·7	11·3	13·0	—	57,000	50,000	44,000	36,000
2·8	8·7	10·5	12·2	14·0	—	61,000	54,000	47,000	39,000
3·0	9·3	11·2	13·1	15·0	—	—	58,000	50,000	42,000
3·2	10·0	12·0	14·0	15·9	—	—	62,000	54,000	45,000
3·4	10·6	12·7	14·8	16·9	—	—	—	57,000	48,000
3·6	11·2	13·5	15·7	17·9	—	—	—	60,000	50,000
3·8	11·8	14·2	16·6	18·9	—	—	—	—	53,000
4·0	12·5	15·0	17·4	19·9	—	—	—	—	56,000
4·2	13·1	15·7	18·3	20·9	—	—	—	—	59,000
4·4	13·7	16·4	19·2	21·9	—	—	—	—	62,000

(1) The fleece density or percentage skin area occupied by the wool fibres, is the product of the number of fibres per square inch and the average cross-sectional area of the fibres (in square inches), multiplied by 100.

(2) The ratio of straight fibre length to the staple length (i.e. crimp ratio) is assumed to be 1·4.

Table 1 shows to what extent the different fleece weights are controlled by the wool length, the fleece density and the quality number of the wool on a well-grown type of ram. It is shown, for example, that in a stud ram with a 60's wool, having 40,000 fibres per square inch of skin, every one inch in staple length adds 3 lb. of clean dry wool to the fleece (or about 7¾ lb. of greasy wool when the yield is 45 per cent. reckoned at 16 per cent. Regain). It is also shown that every 10,000 fibres per square inch of skin on such a ram adds from 1·8 to 3·0 lb. of clean dry wool to the fleece, depending on the length. Incidentally, these facts stress the importance of a good length for stud sheep.

The question of what constitutes stud-wool production in rams has long been discussed by merino breeders, but until tests were available this was largely a matter of surmise with no experimental backing.

From the numerous analyses available it would appear that 10 lb. of clean bone dry wool should be regarded as the minimum produc-

* Biological Studies of South African Merino Wool Production—V. Bosman, The Journal of the Textile Institute, 1937.

tion of merino stud rams. This fact is also demonstrated in Table 1, where fleece weights are given in combination with density, length and fibre fineness.

It has always been accepted that density of fleece constitutes an important requisite in stud merinos, and if one fixes the minimum fleece density for stud sheep at 2·2 per cent. (a figure which, from available analyses of different studs, appears to be a reasonable minimum), then 10 lb. is also indicated. Where 10 lb. is produced with a fleece density of less than 2·2 per cent., the average length must be at least 4 inches and such a ram would be lacking in stud density. It must, however, be borne in mind that the fixing of minimum wool production, just as with the fixing of milk production for the Advanced Registry Classes of Friesland Cows, is an arbitrary measure.

It must also be mentioned that a minimum of 10 lb. is intended for adult stud rams. A two-tooth ram, for instance, would, according to experimental data, produce a fleece of approximately 8 lb. of clean dry wool to qualify for the minimum stud standard.

On this basis the production of adult stud rams ranges from 10 to 16 lb. of clean dry wool (or 11·6 to 18·5 lb. of clean wool at 16 per cent. Regain). The sub-division of stud-ram wool production into high and low wool producers is an arbitrary one within this range.

A ram producing 10 lb. of clean dry wool should shear a greasy fleece of from about 18 to 25 lb. depending on its yield. Likewise, one producing 16 lb. of clean dry wool should shear from 30 to 40 lb. depending on its yield.

TABLE 2.—*The wool production in relation to the fleece characteristics of stud ewes that have a skin area of 10 square feet. (Theoretically calculated.)*

Fleece density as per cent. skin area occupied by wool fibres. (1)	Clean weight of fleece, in lb. (bone dry) for different staple lengths. (2)				Number of fibres growing per square inch of skin for fleeces of different quality numbers according to fibre fineness.				
	2½ in.	3 in.	3½ in.	4 in.	70's.	66's.	64's.	60's.	58's.
1·6	3·3	4·0	4·7	5·3	39,000	35,000	31,000	27,000	22,000
1·8	3·7	4·5	5·2	6·0	44,000	39,000	35,000	30,000	25,000
2·0	4·2	5·0	5·8	6·6	49,000	43,000	39,000	33,000	28,000
2·2	4·6	5·5	6·4	7·3	53,000	48,000	42,000	37,000	31,000
2·4	5·0	6·0	7·0	8·0	58,000	52,000	46,000	40,000	34,000
2·6	5·4	6·5	7·6	8·5	—	57,000	50,000	44,000	36,000
2·8	5·8	7·0	8·1	9·3	—	61,000	54,000	47,000	39,000
3·0	6·2	7·5	8·7	10·0	—	—	58,000	50,000	42,000
3·2	6·6	8·0	9·3	10·6	—	—	62,000	54,000	45,000
3·4	7·1	8·5	9·9	11·3	—	—	—	57,000	48,000
3·6	7·5	9·0	10·5	12·0	—	—	—	60,000	50,000
3·8	7·9	9·5	11·0	12·6	—	—	—	—	53,000
4·0	8·3	10·0	11·6	13·3	—	—	—	—	56,000
4·2	8·7	10·5	12·2	14·0	—	—	—	—	59,000
4·4	9·1	11·0	12·8	14·6	—	—	—	—	62,000

(1) The fleece density or percentage skin area occupied by the wool fibres, is the product of the number of fibres per square inch and the averag cross-sectional area of the fibres (in square inches), multiplied by 100.

(2) The ratio of the straight fibre length to the staple length (i.e. crimp ratio) is assumed to be 1·4.

It must be noted that the theoretical possibilities of obtaining fleeces of more than 16 lb. of clean dry wool and which are included in Table 1, have not yet been practically demonstrated.

Stud Ewes.

The wool production of breeding ewes, for a twelve months' growth, ranged from about 8 to 20 lb. in the grease and from about 4½ to 10½ lb. of clean, bone-dry wool. Table 2 gives the different fleece weights in relation to the fleece characteristics for a type of ewe that is well-grown with a skin area of 10 square feet and a body weight of from 80 to 90 lb.

From Table 2 comparisons can be made similar to those used in Table 1 for stud rams. For example, in a stud ewe with a 60's fleece and 40,000 fibres per square inch of skin, every 1 inch in staple length adds 2 lb. of clean dry wool to the fleece (or about 4½ lb. of greasy wool when the yield is 50 per cent., reckoned at 16 per cent. Regain).

In such sheep every 10,000 fibres per square inch of skin adds from 1·2 to 2 lb. of clean dry wool to the fleece, depending on the length. (Again as was shown with stud rams, the importance of a good length in stud ewes is stressed.)

From available tests on stud ewes and by fixing a minimum fleece density of stud-ewe fleeces at 2·2 per cent. (similar to that suggested for rams) it is evident that the minimum production of stud ewes should be in the vicinity of 6½ lb. of clean dry wool. According to the available experimental data, this could possibly be reduced to 6 lb. where the ewe rears a lamb. On this basis stud-ewe production ranges from 6 to 10½ lb. of clean dry wool (or 7 to 12 lb. at 16 per cent. Regain). The theoretical cases of production of more than 10½ lb. of clean dry wool, and given in Table 2, have not yet been recorded in practice.

Ewes producing 6 lb. of clean dry wool should shear from 9 to 15 lb. of greasy fleece, depending on their yields. Those producing 10½ lb. of clean dry wool should shear about 20 lb. of greasy fleece.

Fleece Testing for Breeding Records.

The many advantages of recording systems based on performances, whether these be the egg-production records of poultry, or the milk-production records of dairy cows, or the progeny tests of Friesland bulls, have been decisively demonstrated. Whether and to what extent similar performance tests on wool production are applicable and advantageous to merino stud-breeding practice, is a matter of speculation amongst breeders.

The ten years of fleece testing and merino recording at Onderstepoort and the relevant research work has demonstrated many fundamentals in fleece testing and has indicated several advantages that should be gained by applying the results of this work. It is certain that a well-planned and properly controlled breeding policy within the stud, when this is assisted by performance records, has many advantages. Such a system does involve records of individual fleece tests on rams or group tests on the wool production of ewes, or group tests on the progeny of different sires, and requires a certain amount of extra work and care, and for this reason has probably been avoided by merino breeders. The work involved is, however, considerably reduced by employing group tests of fleeces, the details of which have been worked out, and those breeders who have adopted systems, modified to meet their practical conditions, have already reaped the benefits.

Progeny Tests for Merino Sires.

A useful application of performance records based on wool production lies in the progeny testing of merino stud sires. One of the requisites for a system of reliable progeny tests of rams is that records must be kept of tests on the ram, on the ewes and on the progeny.

The progeny testing of rams has not generally received the attention it deserves and the practice of purchasing high-priced merino sires whose pedigree and breeding are often unknown both to the buyer and to the breeder, or using sires in the stud on their outward appearance only, without knowing what the breeding potentialities of such rams are, has often been the cause of setbacks in the advancement of studs and has resulted in severe financial losses to the breeder.

It has already been shown that a system based on the progeny testing of rams, similar to that established by progeny tests of other forms of live-stock, has been responsible for rapid advancements in the stud. The use of progeny-tested rams is even more advantageous as regards the general improvement by breeding of the stud than is the system of rigid culling and selection of ewes. The culling and selection of ewes has the advantage that the better class of producers are retained, thus tending to lower the costs of production; but for quickly improving upon the stud in successive generations, the use of progeny-tested rams is preferable, breeding advancements being more rapid than by culling ewes.

Group Tests.

The large amount of work involved in the individual fleece tests of a whole stud has been a drawback to the general adoption of merino recording. Methods for testing groups of animals, however, whereby this work is considerably reduced, are available and have brought recording within the realms of practice.

Group tests for wool production can be applied to the whole stud and, in its simplest form, is the greasy weight of all the wool produced, divided by the number of sheep shorn, which figure gives the average grease-wool production per sheep (assuming that all the sheep were previously shorn at the same time). The average clean wool production in the stud can be obtained by drawing, for laboratory tests, representative samples from all the fleeces produced and then calculating the average clean-wool production per sheep.

It is useful to know the average wool production within the stud so that improvements can be studied and compared from year to year. Such group testing can also be applied to portions of the stud, for example, a group of ewes that is to be mated to a certain ram, or a group comprising the progeny of a certain ram, and is indispensible in any scheme of progeny testing of stud rams.

Although group testing for wool production serves a useful purpose in those cases where individual fleece tests cannot be undertaken, its disadvantage is that a measure of the individual variation within the stud is not available.

In a comprehensive scheme of merino-stud testing, a certain amount of individual testing is essential. This would involve the testing of individual rams and, where records of sheep weights are kept, the weighing of each sheep.

Necessities in Merino Recording.

The necessary requisites for recording include a reliable system for identifying individual sheep, such as eartagging, skin tattooing, etc.*

Equipment should include a reliable platform scale, a milk scale, a suitable ruler for measuring the wool length and a record book and bags or containers for collecting wool samples or fleeces.

The recording of merino-stud sheep would not be complete without records of fertility, lamb-rearing potentialities, type, whether plain or developed, constitutional and conformational points, etc.

With methodical persistence and intelligent application, merino recording cannot but have progressive advantages in merino breeding. The extent to which the details of recording can be developed is almost unlimited and breeders must decide for themselves on what characteristics their initial records will depend. It is usual to begin with those characteristics which are easily obtained and which involve the minimum amount of work.

Summary and Conclusions.

Points of practical application, originating from the merino-fleece testing service, undertaken at the Onderstepoort Sheep and Wool Research Laboratories during the past ten years, are outlined.

The accumulated data and relevant researches have shown what standards of wool production are prevalent among stud sheep and these are discussed in relation to the characteristics that control production. It is suggested that the clean dry wool production of merino stud rams should range from 10 to 16 lb., and that of stud ewes from 6 to 10½ lb. The factors of length, fibre fineness and fleece density are discussed in relation to these standards of production.

Some points of practical application originating from the testing service are outlined. It is contended that fleece testing is a necessary basis for reliable progeny tests of stud rams, a point that is regarded as of paramount importance in the future advancements of merino stud breeding.

It is suggested that a system of group-testing, involving less work than individual fleece tests, might profitably be adopted.

* In critical tests, where an infallible identity of individual sheep is necessary, the system of nose printing, described in a former issue of *Farming in South Africa* ("The Recording of Merino Sheep by Noseprints"—V. Bosman, Feb. 1941, Reprint No. 18, 1941), is being successfully applied. Reprints of the publication are obtainable from the Director of Veterinary Services, Onderstepoort.

SHORTAGE OF TETROL.

THE Director of Veterinary Services, Onderstepoort, announces that owing to the shortage of one of the ingredients of tetrol it is at present no longer possible to prepare supplies of this remedy. In view of the prevailing war conditions, it is extremely difficult to say when supplies will be available again, but as soon as this Institution is able to resume the preparation of tetrol, the necessary notification will be given in regard to the matter.

Farmers are therefore requested not to place any further orders since any money forwarded, must merely be refunded.

A Leaf-Spot Disease of the Olive.

G. J. M. A. Gorter, Department of Plant Pathology, Stellenbosch-Elsenburg College of Agriculture.

WITH the prevailing high prices for olives and of olive oil it is in the interest of growers that their olive groves receive more attention and better care than has hitherto been the case. For that reason the attention of growers is drawn to a leaf-spot disease which during recent years was the cause of such severe defoliation in the olive grove on the experimental farm at Elsenburg, that the

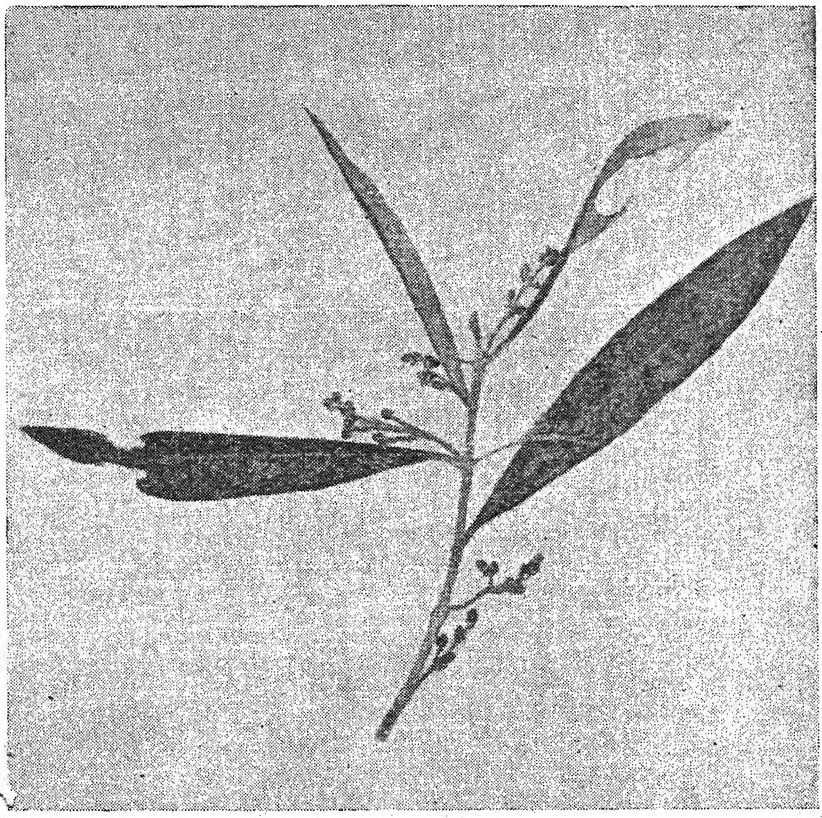

FIG. 1.—*Cycloconium* leaf spots in the variety *Mission*. To the right is an affected leaf which has already started to fade. The white specks on the leaf at the left are due to insect injury.

yield per tree was appreciably reduced thereby. It is highly probable that this disease also occurs in other groves in the western Cape Province as the cause of defoliation occasionally referred to in the past by growers. The organism responsible for this disease is a fungus, *Cycloconium oleaginum* Cast., which has been recorded as causing considerable damage in various countries bordering the Mediterranean.

Symptoms.

The symptoms of the disease are, as a rule, most evident during the spring, just before the trees commence to blossom. A large

percentage of the leaves on affected trees at this stage show yellowing and are affected by a greater or smaller number of circular green spots. The majority of these are from 3 to 5 mm. in diameter; often, however, they attain up to 10 mm. in diameter. Close examination of apparently normal leaves often reveals the presence of inconspicuous circular spots, 2 to 5 mm. in diameter and of a somewhat deeper green colour than that of the surrounding tissue. At a later stage of the disease the central area of such spots, which develop only on the upper surface of the leaves, usually turn chlorotic. Surrounding the spot is a zone of slightly discoloured tissue about ½ mm. wide. The affected leaves rapidly turn chlorotic so that the spots,* which retain their green colour, ultimately contrast very distinctly with leaf tissues surrounding them (Figs. 1 and 2). Occasionally the tissue in the spots shows signs of necrosis (Fig. 3). During the summer months leaves have also been found on which the spots had distinctly turned black. Once the affected leaves have turned yellow, they drop relatively early.

Susceptibility of Varieties.

From observations it was evident that the different olive varieties are not equally susceptible. *Mission* and *Oblizia*, for example, appear to be very susceptible, and *Manzanillo* and *Sevillano* fairly resistant. In some cases, however, the latter two varieties have shown a fair amount of infection. No symptoms of the disease could be found, at least not during the growing period of the leaves, on *Nevedillo Blanco* which apparently is highly resistant to this disease. However, when the old leaves are being shed during the summer, symptoms of infection can be detected on chlorotic leaves in this variety.

Control.

During the past two years spraying experiments were conducted on badly infected *Mission* and *Oblizia* trees. Continual rains during the winter months of 1941 rendered the orchard soils too wet for spray operations with a power spray pump. Consequently only spring applications could be made. The fungicides used were lime sulphur and homemade Bordeaux mixture, of the following strenghts, 1 in 50 and 4:6:100 respectively. Slaked lime was used for the preparation of the Bordeaux mixture. The first application was made just prior to the blossoming of the trees, the second when about ¾ of the petals had fallen, and the third 14 days after the second application. None of these applications appreciably controlled the disease.

The following season one winter application was made in which Bordeaux mixture, 4:4:50, and lime sulphur, 1:25, were used. This was applied early in July and about one month after the picking of the olive crop had been completed. The winter application was followed by the application of the same spring treatments as in the previous season. The results showed a striking improvement in the condition of the trees sprayed with Bordeaux mixture. Not only did

*) An examination of cross sections through such spots under the microscope clearly reveals the presence of a thin layer of dark-coloured, closely interwoven mycelial threads between the epidermial cells and the protecting cuticula. These fungal threads penetrate the cuticula and emerge at numerous points perpendicular to the surface of the leaf on which they then develop either short and slender, one- to three-celled sterile fungal threads, or thick, round cells, each of which may give rise to a spore. The spores are mostly one-celled and egg-shaped with a rather thick wall, dark olive-brown in colour and show numerous drops of oil within the cell-contents which give the spore surface a warty appearance. The diameter of the spores as well as that of the conidiophores is usually 10 mm.

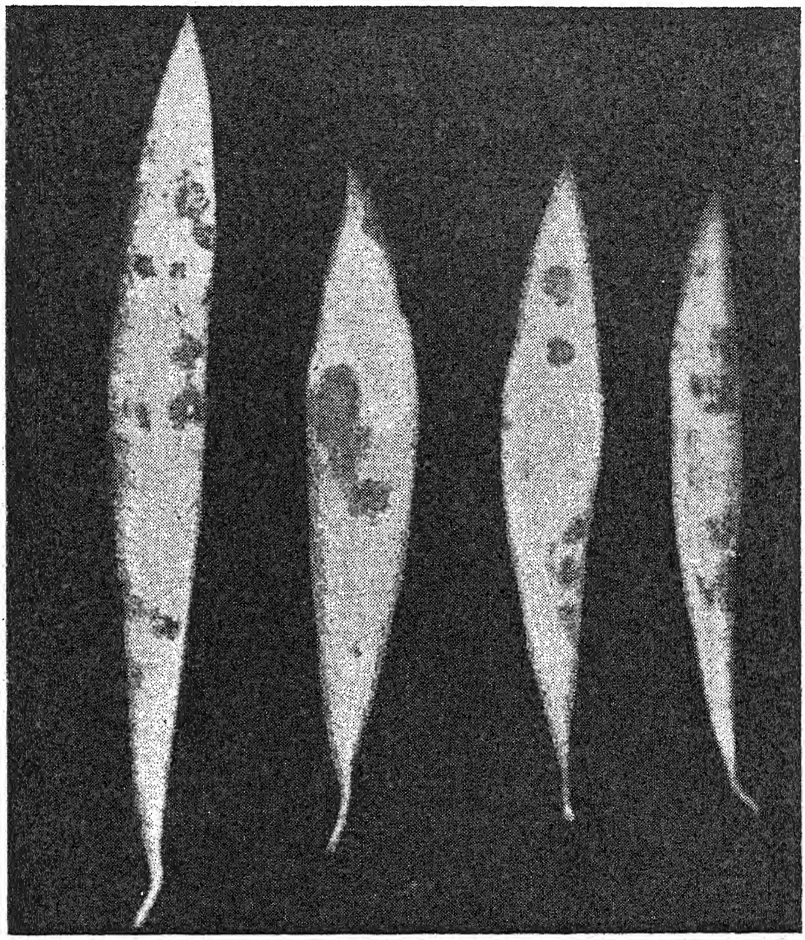

FIG. 2.—Infected *Sevillano* leaves which have turned chlorotic and on which the green leaf spots are clearly depicted.

a much denser foliage result, but no spots developed on the leaves of these trees during the whole growing-season, whereas unsprayed trees as well as those sprayed with lime sulphur developed severe leaf infection. No differences as to infection could be detected between the unsprayed trees and those sprayed with lime sulphur.

TABLE: *Showing Results of the Spraying Experiment in* 1942.

Variety.	Spray.	Date of Application and Strength of Sprays.				Number of Experimental Trees.	Number which Flowered.	Yield of Trees which Flowered.	
								Total.	Average
		14/7/42.	25/9/42.	30/10/42.	17/11/42.			lb.	lb.
Mission...	Bordeaux mixture	4:4:50	4:6:100	4:4:100	4:4:100	3	3	272	90·6
	Lime Sulphur....	1:25	1:60	1:60	1:45	3	2	74	37
	No spray........	—	—	—	—	4	2	63	31·5
Oblizia...	Bordeaux mixture	4:4:50	4:6:100	4:4:100	4:4:100	3	2	130	65
	Lime Sulphur....	1:25	1:60	1:60	1:45	3	2	7	3·5
	No spray........	—	—	—	—	4	2	11	5·5

The Bordeaux mixture not only controlled the leaf disease, but also beneficially influenced the yield of the trees, as is clearly reflected in the data presented in the table.

Recommendations.

Since the same trees had been used in the spray tests in both seasons it cannot be said with certainty that the beneficial effect from the applications of Bordeaux mixture was solely the result of the

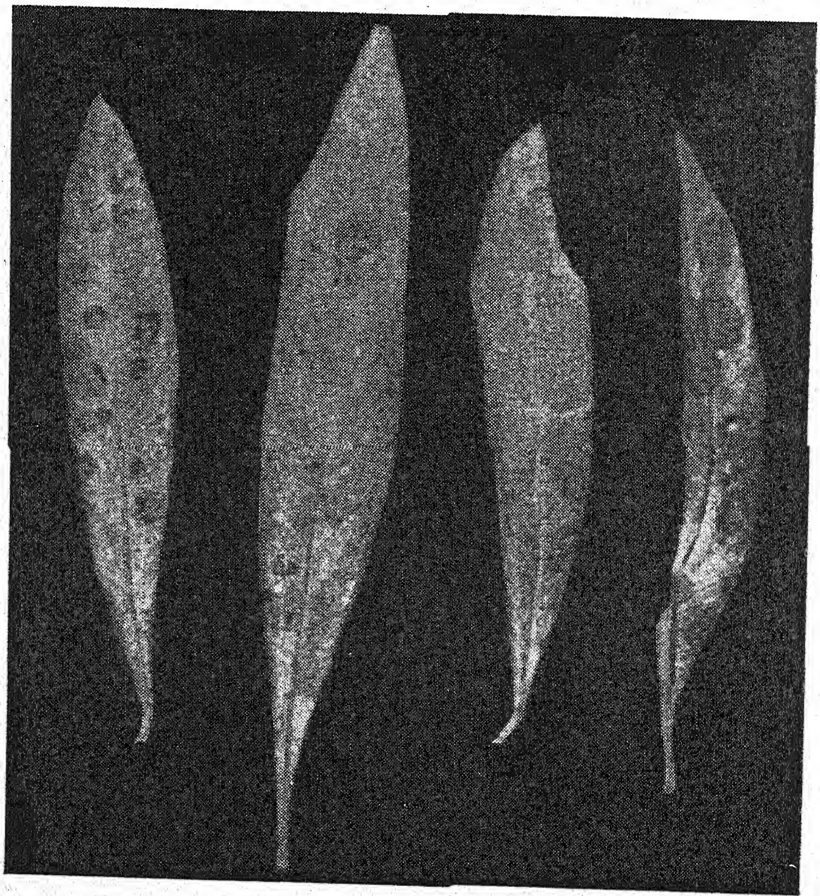

FIG. 3.—Infected leaves of the variety *Oblizia*. Note the dark dots in the spots on the leaves at the left, which indicate necrotic tissue.

winter application. It might well be that the application of Bordeaux mixture on the young leaves during the spring of 1941 had already had a protective effect on the leaves before the winter spray was applied in 1942. Pending the results of further spraying experiments it is therefore recommended to spray thoroughly with Bordeaux mixture (4:4:50) at the beginning of the winter after the crop is picked, and to make one further application during the spring (4:4:100) as soon as the young leaves develop and when the trees have almost finished flowering. It is also recommended that old fallen leaves be ploughed under.

Wherever new olive groves are started, it is desirable that this disease be taken into consideration, and that only resistant varieties

[Continued on page 801.

Sheep-Blowfly Investigations in the Winter Rainfall Area.

Dr. H. O. Mönnig, Research Officer, and P. A. Cilliers, Technical Assistant, Onderstepoort.

THE researches of the past few years on the blowfly problem have brought to light important facts in regard to the kinds of blowflies that breed in carcases during the different seasons of the year, in comparison to those kinds that strike live sheep. The first experiments were carried out in the summer rainfall area, and it was suspected that the conditions obtaining in the winter rainfall area may cause blowfly life there to look somewhat different. Consequently experiments were also carried out in this area over a period of one year, and have just been concluded.

Nature of the Experiments.

The object of the experiment was:—

(1) To collect maggots from struck sheep throughout the year in order to ascertain which kinds are responsible for strikes.

(2) To expose carcases of sheep and smaller animals regularly in order to determine which kinds of flies breed in them.

(3) To catch blowflies with ordinary meat bait in order to compare the catches with the results of (1) and (2).

(4) To measure regularly the rainfall, temperature and humidity for comparison with the other results.

The experiments were carried out on Mr. G. Albertyn's farm Driefontein, three miles east of Bredasdorp, where the owner kindly provided all the facilities.

Climate.—During the period of the test, i.e., beginning of July 1942, to end of June 1943, 15½ inches of rain fell, distributed over the year in such a way that it was never dry and the conditions for blowfly strike were always favourable.

In general it was cool and cloudy; cold days with misty rains occurred periodically after the winter, even until November. Only in December it was fairly warm, but in January fair rains caused the temperature to drop.

Strikes on Sheep.—Maggots from living sheep were collected at Bredasdorp, Caledon and also at Stellenbosch. Altogether 55 samples with a total of over 5,000 maggots were examined. A larger number of specimens would have been desirable, but these 55 represent all seasons of the year and may be regarded as a fair sample. Without exception they were maggots of the green sheep blowfly, *Lucilia cuprina.*

Carcase Tests.

(1) *Sheep carcases.*—Eight tests were made, each with two sheep, as follows: The sheep are killed and each is placed on an 8-inch deep layer of sand in a large iron trough. One trough is closed after one day in warm weather, or two days in cool weather; the other after seven days or longer. When the flies emerge they are collected, sorted and counted. The object is to determine which kinds of blowflies lay eggs on a fresh carcase and what happens when competition between all kinds is freely allowed, as in the carcase left open for the longer period. Only eight tests could be made because the development

proceeds slowly in cool weather and one has to wait for all flies to emerge before the next test can be started. The results are given in the following table:—

Blowflies bred from sheep carcases.

Started.	Left Open.	*L. cupr.*	*L. seric.*	*C. chlor.*	*C. alb.*	*C. marg.*
8/7/42..........	Short....	0	1,570	25,056	2,778	57
,, ...	Long....	0	396	61,304	129	0
25/8/42..........	Short....	0	0	63,355	6,058	0
,, ...	Long....	0	0	59,780	9,671	2,776
13/10/42..........	Short....	0	0	48,507	4,949	0
,, ...	Long....	0	0	5,246	6,820	525
17/11/42..........	Short....	0	0	8	1,027	0
,, ...	Long....	0	0	0	1,567	683
22/12/42..........	Short....	0	42	324	2,454	50
,, ...	Long....	0	0	16	24,061	185
16/2/43..........	Short....	0	0	38	4,076	29,209
,, ...	Long....	0	0	236	11,342	4,091
29/3/43..........	Short....	0	0	0	13,884	26,395
,, ...	Long....	0	0	0	8,864	24,128
11/5/43..........	Short....	0	0	1,204	594	1,366
,, ...	Long....	0	0	0	972	3,456

EXPLANATION.

L. cupr. = *Lucilia cuprina*, the important sheep blowfly.
L. seric. = *Lucilia sericata*, a green blowfly which very seldom attacks sheep and then apparently only when the sheep have already been struck by other kinds.
C. chlor. = *Chrysomyia chloropyga*, the coppertail blowfly which sometimes strikes sheep.
C. a.b. = *Chrysomyia albiceps*, the banded green blowfly, or secondary sheep blowfly which strikes sheep only after they have been struck by other kinds.
C. marg. = *Chrysomyia marginalis*, the large blue-bottle which does not strike sheep.

The important sheep blowfly, *L. cuprina*, did not breed from sheep carcases in a single instance, although it was always present and striking live sheep. *Lucilia sericata* apparently is a fly that does not like breeding in large carcases, or it is easily pushed out by other kinds.

In the winter and until October the coppertail blowfly had the upper hand in the carcases, while *C. albiceps* and *C. marginalis* were not very active. After that only small numbers of this kind emerged from carcases.

In November certain kinds of carcase-beetles were very active and they destroyed many blowfly maggots.

From December onwards *C. albiceps* and *C. marginalis* were very active. As is known they are frequent only during the warm season. Until May they had the upper hand in the carcases.

(2) *Small carcases.*—During the year 304 carcases of small animals were exposed: birds of various sizes, mice, rats, lizards, tortoises, frogs, polecats, hares, etc. They were left open as long as possible, until the flies were about to emerge.

As had been found in previous tests, small carcases under about one pound in weight gave different results than did those weighing over one pound. In the small carcases (under 1 lb.) *Lucilia sericata* bred throughout the year, accompanied by the grey blowfly *Calliphora croceipalpis* in winter and the grey flesh-fly *Sarcophaga* in summer. The latter two kinds do not strike sheep. Only 4 out

of 59 carcases exposed between 10th July 1942 and 24th September 1942 produced a few *L. cuprina* each and none bred in small carcases after that date. The larger carcases, over 1 lb. in weight, gave results that correspond to those obtained from sheep carcases, except that *L. sericata* also bred in them. Such carcases, therefore, form a transition between small and large carcases. In no case did *L. cuprina* breed in them.

Blowfly Trap.—Sheep's intestines were used as bait and were renewed weekly. The catches of the first three days and the next four days were separately recorded, but the cool climate caused decomposition of the bait to proceed slowly, and consequently there was little difference between the two groups of data. The catches reflect in general the occurrence of the different kinds in the different seasons, as also indicated by the carcase tests, viz., the coppertail especially during the winter, *C. albiceps* and *C. marginalis* during the summer. Of importance is the fact that the number of *L. cuprina* was always very low and represents only 6¼ per cent. of all blowflies caught during the whole period, although the bait decomposed slowly and should always have been fairly attractive to this kind of blowfly.

Conclusions and Recommendations.

(1) In the area in which the test was made, the moist climate favours blowfly strike of sheep throughout the year.

(2) *Lucilia cuprina* is by far the most important sheep blowfly. The coppertail is, apparently, unimportant although it occurs in large numbers and breeds in large carcases during the winter.

(3) Carcases are unimportant as breeding places for *L. cuprina*. Since the coppertail may strike sheep under certain circumstances, it is desirable to destroy large carcases from about June to October. During the other months they should simply be buried after about two days.

(4) Blowfly traps with meat bait are of no use in the control of sheep blowflies.

(5) Since *L. cuprina* breeds practically exclusively on live sheep, the best control measure will be the regular treatment of all struck sheep with the object of killing all maggots. "Blowfly Spray", the only really effective remedy, should be use.

(6) Selective breeding to reduce the susceptibility of sheep should be carried out, as well as crutching and regular treatment against internal parasites in order to prevent purging.

A Leaf-spot Disease of the Olive:—

[Continued from page 798.

such as *Nevadillo Blanco* be planted. Another variety known to be resistant is the European variety *Leccina*. The variety *Leccina*, which has been imported into South Africa from South America, is presumably identical with the variety Leccina from Europe.

The Control of the Small Cabbage Moth.

DURING the past six years intensive investigations have been made on the natural mortality factors which serve to limit infestations of the small cabbage moth, *Plutella maculipennis* Curt. on market garden crops. Some highly important results have been obtained which have a direct bearing upon the successful control of the pest. Many of these are being tested before being finally recommended for putting into practice. In view of the importance of market garden crops during the present war period, however, the more immediate of the proved measures is suggested here.

Natural Enemies of the Moth.

It has been found that the natural enemies of the moth (parasites and predators) can give up to 90 per cent. control of the population of caterpillars. There are times, however, when through unfavourable circumstances, this control breaks down and an epidemic of the pest occurs. It is now known how this is caused and it is hoped that, in future, it will be possible to prevent this happening. When such an epidemic occurs, the grower is faced with the loss of his crop, unless he applies some chemical control measure. It is, however, possible to forestall such outbreaks in many cases by a very simple procedure, while at the same time preserving the valuable natural enemies.

If we wait until an outbreak is in progress before taking any steps to control it, we are bound to destroy large numbers of the parasites and predators. We must, therefore, do something *before* the latter become established in the crop.

The number of moth larvae necessary to produce a given amount of damage naturally varies with the age of the crop. A few larvae may do serious damage to a very young plant, whereas the effects of feeding by many larvae will pass almost unnoticed on a larger plant.

It has been found that the most susceptible period in the life of the crop is during the first three weeks of growth after planting out from the seed-bed. During this period, a low infestation of cabbage moth larvae has its greatest effect and may seriously affect the subsequent growth of the plant. This low population may not be noticed until too late. Steps should be taken to protect the crop during the susceptible period and, except under unusual circumstances, later infestations can generally be ignored.

Dipping of Transplants.

This is very simply done by taking care to plant out only clean seedlings from the seed-bed. The young plants may be freed from the caterpillars present by immersing them in a mixture of lead arsenate and spreader in water made up to normal spraying strength. The recommended strength is three ounces of lead arsenate powder with half an ounce of calcium caseinate spreader, well mixed in four gallons of water. Keep the mixture well stirred while dipping to prevent the arsenate of lead settling to the bottom of the tin. A small drum of this is mixed and kept near to the seed-bed and each handful of plants is thoroughly dipped in it before being taken to the lands.

The protection afforded by this method lasts from two to three weeks, i.e., for the duration of the susceptible period in the growth of the plant.

At the same time, the seed-beds themselves should be left untouched (i.e., without spraying or other treatment) for as long as

[Continued on page 806.

The Spraying of Citrus Trees for Scale Control.

A. J. Smith, Citrus Entomologist, Rustenburg.

FOR the successful control of scale insects on citrus trees by spraying, particular attention must be paid to the following points:—choice of spray material; mixing and application of the spray; and the time of application.

Choice of Spray Material.—Various oil sprays, made from mineral oil, also known as petroleum or lubricating oil, animal or fish oil and vegetable oil, have given promising results as scalecides on citrus. Oil sprays made from mineral oils, however, are used most extensively in South Africa and as practically all the oil sprays, used by citrus growers, belong to this group, a discussion of the properties of these oil sprays may be of interest to growers.

Oil Sprays.

Unsulphonatable Residue.—Crude mineral oil is injurious to plant tissues, and has to be purified before it can be used for the manufacture of sprays. The degree to which an oil has been purified is indicated by the percentage of unsulphonatable residue which it contains. This is usually expressed as U.R., thus, an oil spray with an U.R. of 90 per cent. still contains 10 per cent. of impurities which may be harmful to plant tissues. Miscible oils and the grades of light oil emulsions usually have a lower purity than the heavy grades because the latter are more liable to be injurious to plant tissues and require more purification. Apart from the sulphonation test, attention should also be paid to the following properties of oil sprays:—

Volatility.—This is determined by distilling the oil and is usually expressed as the percentage of oil that will distil over or evaporate at or below a temperature of 635 degrees F. The figure thus obtained is considered to be an index of the heaviness of the oil and the grading of oil sprays into the grades light, light medium, medium, heavy medium and heavy, is based on this figure. It also gives an indication of the persistence of the oil film deposited on the tree by the spray.

Viscosity.—This can be described as the flowability or rate of flow of an oil and is measured by the time a definite quantity of oil at a specified temperature takes to pass through a definite size orifice. The viscosity index figure is not a true indication of the volatility of an oil spray but rather a measure of the rate the oil is able to penetrate plant tissues.

Oil Content.—As the efficiency of an oil spray is largely determined by its oil content, growers should pay particular attention to the oil content of the stock emulsion they buy.

The following types of oil sprays are obtainable:—Miscible oils, oil emulsions and emulsive oils. Briefly, the properties of each of these types are as follows:—

Miscible Oils.—A miscible oil, also referred to as "red oil", can be described as a mineral oil which is mixed with soap or some other emulsifier and contains no water. Its appearance and consistency resemble that of unemulsified lubricating oil.

When mixing this type of oil with water, care must be exercised to do so slowly and to keep the mixture well agitated, otherwise the emulsion may break.

Miscible oils are less safe to use on green foliage such as citrus or as summer sprays than either oil emulsions or emulsive oils and are, therefore, used mainly as dormant or winter sprays.

Oil Emulsions.—Also known as "white oils", due to their white colour, are mineral oils emulsified in water with various types of water-soluble emulsifiers. The consistency of this type of emulsion is largely determined by the type and amount of emulsifier used and may vary from a thin, free-flowing to a thick, pasty emulsion. The oil depositing and spreading properties of the oil, which largely govern the scalecidal properties of this type of emulsion, are dependent upon the kind and amount of emulsifier used. These oil emulsions usually contain about 15 per cent. of water.

Emulsive Oils.—These are also known as emulsifiable, emulsible and soluble oils and are made of mineral oils in which one or more ingredients, known as solutes, are dissolved. These act as emulsifiers when mixed with water. As the emulsifiers are oil-soluble, emulsive oils contain no water in contra-distinction to the oil emulsions.

The solutes have a very important bearing on the efficacy of these oils as the oil depositing properties, the uniformity of the oil film over the scale insects, and the penetration and absorption of the oil into the plant tissues are largely governed by the type and amount of solutes used. Owing to the fact that oil deposition and penetration can be regulated by the solutes used, it is considered that this type of oil spray has a definate advantage over the oil emulsion type. Also by incorporating certain elements which are directly toxic to the scale insects and which are soluble in the oil, the efficiency of the spray, as a scalecide, can be increased.

Mixing and Application of Oil Sprays.

Apart from the properties of the oil sprays, careful attention must be paid to the following factors as they also have a very important bearing on the results of spraying.

1. Mixing of materials. Measure out the correct quantities and mix the oil and water as recommended by the manufacturers. A standard strength for many oil sprays is 2 per cent. of the stock emulsion in water.

2. A good spray pump, preferably a power sprayer, giving a high pressure of approximately 400 lb. to the square inch, is very desirable. A much better coverage and consequently a more uniform oil deposit is obtained with a high pressure than is possible with a low pressure. Also, with tight emulsions a high pressure is necessary to break the emulsion. Where hand pumps are used, it is advisable to use a weak or quick breaking type of oil emulsion otherwise an unsatisfactory oil deposit may be obtained. Good agitation is also very important in order to maintain an even mixture of the oil and water. With unstable and quick breaking emulsions, the oil which is liberated in the container is inclined to stratify and to rise to the top, thus resulting in an uneven mixture being applied to the trees.

3. Growers should bear in mind that oil sprays kill only by contact and that the insecticidal efficiency of any oil spray largely depends on the quantity and uniformity of the oil deposited over the insects. When spraying, therefore, the aim should not only be to hit the insects but to cover every one with an effective oil film. To achieve this most difficult task, both the inside and the outside of the trees must be thoroughly sprayed according to a fixed plan. On the other hand, care should be taken not to overspray as this is uneconomical and may also result in damage to the trees and crop.

Also, failure to get a satisfactory control, due to poor spraying cannot be remedied by increasing the oil content of the spray mixture. Rather check on the coverage while the spraying is in progress and see to it that the work is properly done. Do not make the fatal mistake of entrusting the work to an inexperienced sprayman, or, worse still, to natives. Approximately 8 to 10 gallons of spray mixture should be sufficient to spray an average size citrus tree.

Time of Application.

Oil sprays should not be applied during hot weather when the temperature is likely to rise above 90 degrees F., as injury to the trees and crop may then result.

Trees suffering from lack of water should not be sprayed as a heavy leaf-fall and even dropping of fruit may then occur. Where possible, spray after rain or after irrigation. Do not spray during strong winds or when the trees are wet, as both these factors may affect the coverage adversely.

Oil sprays should be applied during the summer months only and spraying can be started when the fruit has reached about the size of a walnut. The period from the middle of December to the end of February is considered safe to apply medium to heavy medium grades of oil. During March and April medium to light medium grades should be used. After April oil spraying should only be done as an emergency measure, when light grades should be applied.

Scale Control.

From the standpoint of both scale control and tree reaction, fumigation is preferred to oil sprays, except where a combination treatment of an oil spray followed by fumigation, is considered necessary.

Unfortunately, owing to lack of fumigation facilities, many growers have to rely on oil sprays for scale control. Such growers are advised to spray early while the scale infestation is still light. It is much easier to control a light infestation on small fruit than a heavy one on big fruit late in the season.

Tree Reaction to Oil Sprays.

The following detrimental effects on trees and fruit by oil sprays have been reported by various overseas investigators:—Leaf and fruit burn; leaf and fruit drop; rough textured fruit; reduction of total soluble solids resulting in insipid fruit; retardation of colouring and maturity; increase in dead wood; interference with normal blossoming; crop reduction; increased granulation; and fruit becoming more susceptible to decay.

Ill effects such as fruit and leaf burn, leaf and fruit drop, retardation of colouring and maturity of fruit have been reported in this country. In most cases, however, these occurred where the oil spray was either applied too late in the season or at too high a concentration. By paying careful attention to the above recommendations, much can be done to avoid such damage. In addition, the following precautions should be taken:—

1. Heavy grade oils should not be applied unless conditions warrant it, as these grades have a comparatively small margin of safety.

2. Do not spray trees twice during any one season with medium to heavy medium grades of oil. Where an emergency application is considered necessary, a light grade should be used for the second application.

3. Allow a period of approximately one month after application of sulphur or any sulphur compound before an oil spray is applied.

Animal, Fish and Vegetable Oils.—Owing to the scarcity of mineral oil sprays, due to war conditions, preliminary experiments have been conducted with animal, fish and vegetable oils with a view of finding suitable substitutes.

Encouraging results were obtained with whale and seal oil. Unfortunately, somewhat contradictory results were obtained in spraying tests conducted in different citrus areas, so that further experiments will have to be conducted before definite recommendations as regards the suitability of these oils can be made.

The Control of the Small Cabbage Moth:—

[*Continued from page* 802.

is possible. The high infestation, concentrated within a small area, affords an ideal breeding ground for parasites and forms a reservoir from which they can spread to the main crops on the farm. The treatment described here is both less expensive and more efficient than spraying the crop a week or so after planting out. It is also much less destructive of natural enemies, as these only become established in the crop at a later date. Finally, it is more economical of spray materials.

(Dr. G. C. Ullyett, Officer in Charge, Parasite Laboratory, Division of Entomology, Pretoria.)

Some Hints on Poultry Farming.

Preventing draughts in fowl-houses.—One of the chief causes of colds and roup in poultry is a draughty fowl-house. The roof should fit closely on the side walls. An opening of 3 to 4 inches must be left between the whole length of the back wall and the roof. To prevent side draughts in a long house, there should be a solid division every 25 feet from back to front, fitting the roof closely. Of great importance is the provision of ventilation below the perches, at intervals of 5 to 6 feet, an air-brick or similar substitute should be placed in the back wall, 6 inches from the floor. Outside a baffle plate (a piece of wood or flat iron) is placed over the air-brick, leaning against the wall, 6 inches above the top of the air-brick, projecting 6 inches on either side and resting on the ground 6 inches from the wall.

[E. F. Lombard, Professional Officer (Poultry), East London.]

A Popular Bulletin for the Farmer.

Bulletin 234.—"Re-inforced Circular Reservoirs", obtainable from the Editor, Department of Agriculture and Forestry, Pretoria, at 3d. per copy.

Feeding Experiments with Ducks.

(P. J. Serfontein, Professional Officer, Poultry Research, College of Agriculture, Potchefstroom.)

IN the production of table ducklings, feed is the most important item of expenditure. This expenditure does not only include the cost price of the feed, but owing to its composition, the latter has a certain effect on the final product if the ducklings are slaughtered at the age of 10 weeks. The price realized at this age will depend on the average weight, which in turn favourably or adversely affects the feeding costs.

FIG. I.—Malformed wings in muscovy×Pekin cross at age of 10 weeks.

With a view to the more economic utilization of feed, the following feeding experiments were carried out during the 1942-43 breeding season, namely:—limited feeding from the age of four weeks together with green feed as against full feeding up to the age of 10 weeks, with particular reference to the effect of the percentage of fibre on growth and feather-eating; the effect of flavin and pantothenic acid on the growth of ducklings, and also to the question whether crooked wings, stunted ducklings, hunch-backed ducklings and deformed beaks can be prevented by the feeding of one or both of these constituents, and, finally, whether the addition of manganese

sulphate has any effect on the latter deformities. These abnormalities definitely affect the cost of production, and may even result in the undertaking showing a loss instead of a profit.

Feather-eating is very common among ducklings, usually from the fourth week, after which it gradually becomes worse. The feathers are generally pulled from the back and around the tail. When such ducklings are marketed at the age of 10 weeks, they look unattractive, are very difficult to clean, and even the cleaned carcasses show lesions where the feathers have been pulled out. Feather-eating must undoubtedly have a harmful effect on the digestive system and this in turn will adversely affect the growth of ducklings.

A peculiar abnormality among ducklings is deformed wings (Fig. I). One or both of the wings may be deformed. Although this abnormality develops quite early, it becomes most pronounced at the age of 10 weeks when the primary wing feathers have grown out completely. This condition closely resembles perosis in chicks. In thee latter case thickening of the hock occurs, causing the tendon in the hock to slip out of position, and the metatarsus to be drawn outwards. In ducklings the joint between the metacarpus and the ulna is drawn out of position, with the result that the metacarpus and its attachments are drawn forward into a crooked position. That part of the wing carrying the primary wing feathers is affected, so that the tips of the wings appear to be back to front, giving the bird a very unattractive appearance.

A second abnormality is deformed legs (Fig. II). The legs bend outwards from the heel, so that the bird appears bandy-legged, and in an advanced stage it gives the impression of crossing its legs when walking. The first cases are observed at the age of four weeks.

A third abnormality, deformed beak, is very common on farms where ducklings are not properly fed. This deformity appears from the third week onwards. First the beak flattens and then gradually curls up around the edges.

A fourth and fifth deformity must be discussed together so that the difference between them can be pointed out at the same time, viz. hunched-backed and stunted ducklings (Figs. III and IV). The word hunch-backed was chosen because the bird appears to hunch its back when standing upright. Actually the back is normal, but the neck is crooked. The duck walks with difficulty and the body, up to where the neck begins, assumes the attitude of a penguin. The neck always remains crooked, and the bird is unable to stand upright for any length of time. When the bird sits down, the neck and head are extended along the ground. The eyes secrete a substance which eventually cakes the feathers around the eyes into a black, gummy mass. Such ducklings do not grow well, but some of them attain a weight of 3¾ lb. at the age of 10 weeks. Very few reach the age of 10 weeks, however, although in exceptional cases the birds live to the age of 16 weeks.

Stunted ducklings differ from the hunchbacks in that they are quite normal in build. They grow very slowly, however, and weigh only 2 lb. at 10 weeks. Usually these birds die before reaching that age, but competition and crowding out around the feed hoppers might very well contribute to their untimely death.

The ducklings used in the experiments were Pekins and were hatched in a Petersime incubator. Warmth for the first two groups was provided for one week by a Solhot oil stove. The other groups were reared without artificial heat since it was later than October and heat was therefore no longer necessary. Each group was kept

in a house measuring 10 ft. by 12 ft. up to the age of 10 weeks and had access to runs but not to water in which they could swim. The groups were composed in such a manner that there was an equal number of each sex in each group. Individual weights were taken at fortnightly intervals. The ducklings were fed in the morning and in the afternoon, and the feed was moistened with water to the consistency of a thin mash. Clean water was always available in deep containers.

Limited *versus* Full Feeding from the Age of Four Weeks.

Ducklings readily consume green feed which provides much of the essential vitamins, and the possibility exists that green feed could be substituted for part of the ration, provided the average weight at 10 weeks is not so low that the saving thereby effected is completely neutralized by the loss in weight.

To test this possibility two groups each consisting of 29 drakes and 26 ducks, were made up. For the first four weeks both groups were given exactly the same ration in order to give them a reasonable chance to develop. After the fourth week group 2 was given four-fifths of the ration given to group 1 and the remaining one-fifth was supplemented with double the weight of green feed in the form of finely cut lucerne, which was mixed with the usual ration. In addition, finely cut green lucerne was fed once a day so that a supply was available to the birds all day.

The ration and its calculated constituents are given in Tables I and II.

TABLE I.—*Rations fed from 1st day to 10 weeks.*

Ingredients.	Quantities.
	lb.
Yellow mealie meal	58
Ground Oats	10
Lucerne meal	10
Fish meal (Concentra)	9½
Meat meal and bone meal	6
Groundnut meal	5
Oystershell powder	1
Salt	½
Manganese Sulphate ($MnSO_4$)	½ oz.

TABLE II.—*Calculated constituents of rations.*

Ingredients.	Quantities.
	%
Crude protein	19·57
Crude fibre	4·96
Calcium	1·74
Phosphorus	0·88

The average weights as given in Table III are reasonable for both groups and there is only a small difference between the two groups. According to Table V there was a saving of 0·69 lb. of feed for every pound gained in weight in group 2, as against group 1. No cases of feather-eating occurred in either group, and apart from the stunted and hunch-backed ducklings, both groups were very uniform.

TABLE III.—*Average fortnightly weight per duckling up to 10 weeks of age.*

Group.	2nd Week.		4th Week.		6th Week.		8th Week.		10th Week.	
	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.
1	0·46	0·44	1·35	1·33	2·56	2·61	3·74	3·85	4·20	4·10
2	0·43	0·40	1·34	1·30	2·50	2·35	3·68	3·49	4·15	3·75

TABLE IV.—*Average fortnightly weight per duckling up to 10 weeks to 10 weeks of age.*

Group.	2nd Week. lb.	4th Week. lb.	6th Week. lb.	8th Week. lb.	10th Week. lb.
1..........	0·78	2·64	6·65	11·60	16·10
2..........	0·78	2·60	5·80	9·72	13·13

TABLE V.— *Summary of results and general data.*

Particulars.	4th Week.		10th Week.	
	Group 1.	Group 2.	Group 1.	Group 2.
Percentage mortality (original number in each group 55)......................	9·09	7·09	12·06	7·09
Average feed consumption per duckling....	2·64 lb.	2·60 lb.	16·10 lb.	13·13 lb.
Unit of feed required to gain one unit of weight..............................	1·96 lb.	1·97 lb.	3·87 lb.	3·18 lb.
Percentage feather eaters................	—	—	—	—
Percentage bandy-legged................	—	—	2·04	5·88
Percentage with crooked wings...........	—	—	14·28	19·60
Percentage stunted birds, i.e. birds under 2 lb. at 10 weeks......................	—	—	4·08	3·92
Hunch-backed birds.....................	—	—	—	1·96
Crooked beaks..........................	—	—	—	—

The percentage mortality as indicated in Table V was made up solely of stunted and hunch-backed birds and a few which died during the second day of the experiment.

Brief Summary of Results.

1. In the production of ducks a considerable saving in the feeding costs can be effected by giving green feed from the fourth week, without adversely affecting the average weight at 10 weeks.

2. With the above ration green feed cannot decrease or prevent the incidence of any of the deformities, especially the percentage of crooked wings which was abnormally high.

Second Experiment: Effect of Fibre on Growth, and Feather-eating.

Cannibalism among chicks and fowls occurs in the form of feather-eating, toe-pecking and eating of other parts like the vent, comb, etc. Among ducklings feather-eating is the only form of cannibalism so far encountered. Where this occurs in a severe form, however, the ducklings practically denude each other along the back, around the tail and on the wings, and even pluck out the secondary and primary wing feathers.

During the previous season it was observed that where cases of feather-eating cccured, the ducklings readily consumed wood shavings, after which feather-eating showed a slight decline. For this reason, and also because the available data on chicks prove that oatbran contains a substance which prevents cannibalism, this constituent was also tried out on ducks, in order to determine:—

(*a*) Whether feather-eating among ducklings can be prevented by feeding oatbran.

(*b*) What effect the percentage of fibre has on the growth of ducklings.

Three groups, each consisting of 28 drakes and 34 ducks, were made up.

In order to eliminate the possibility of a deficiency of the vitamin B complex, 5 per cent. brewers' yeast and 3 per cent. molasses were added to each of the three rations. All three rations contain

FIG. II.—Pekin at age of 10 weeks with crooked legs.

TABLE VI.—*Rations fed from 1 day to 10 weeks.*

Ingredients.	Rations.		
	1 lb.	2 lb.	3 lb.
Yellow mealie meal	$66\frac{3}{4}$	$56\frac{1}{2}$	$40\frac{3}{4}$
Lucerne meal	8	8	8
Oatbran	—	10	25
Fish meal (Concentra)	$15\frac{1}{4}$	16	17
Brewers' yeast	5	5	5
Molasses	3	3	3
Bonemeal	1	$\frac{1}{2}$	$\frac{1}{2}$
Oystershell powder	1	1	$\frac{3}{4}$
Manganese suphate	$\frac{1}{2}$ oz.	$\frac{1}{2}$ oz.	$\frac{1}{2}$ oz.

a very high percentage of yellow mealie meal, especially ration 1. The inclusion of a high percentage of maize and maize products in chicken rations is considered to result in poorer feather growth and a greater tendency to feather-eating than is the case when oats or oat products are fed. Even salt was omitted from the rations in order to ensure, according to the data, more ideal conditions for feather eating. The rations and their ingredients are given in Tables VI and VII.

TABLE VII.—*Calculated constituents of rations.*

Constituents.	Rations. 1	2	3
	%	%	%
Crude Fibre	2·91	4·94	7·99
Crude protein	19·70	19·66	19·69
Calcium	1·57	1·54	1·53
Phosphorus	0·88	0·85	0·85

TABLE VIII.—*Average fortnightly weight per duck up to 10 weeks of age.*

Group.	2nd Week.		4th Week.		6th Week.		8th Week.		10th Week.	
	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.
1	0·87	0·82	2·55	2·44	4·03	3·73	4·91	4·53	5·82	5·08
2	0·71	0·75	1·98	2·07	2·96	3·12	4·31	4·39	4·73	4·60
3	0·31	0·37	1·30	1·67	2·65	2·92	3·76	3·80	4·75	4·67

TABLE IX.—*Average fortnightly total feed consumption per duck up to 10 weeks of age.*

Group.	2nd. Week. lb.	4th Week. lb.	6th Week. lb.	8th Week. lb.	10th Week. lb.
1	1·45	5·21	10·86	16·19	22·70
2	0·85	4·15	8·30	14·00	19·20
3	0·60	4·10	9·10	15·00	21·00

TABLE X.—*Summary of results and general data.*

Particulars.	4th Week. Gr. 1.	Gr. 2.	Gr. 3.	10th Week. Gr. 1.	Gr. 2.	Gr. 3.
Percentage mortality (original number in each group 62)	9·6	11·5	3·66	9·6	11·5	36·6
Average feed consumption per duckling	5·21	4·15	4·10	22·70	19·20	21·00
Unit of feed required to gain one unit of weight	2·09	2·04	2·83	4·12	4·13	4·43
Percentage feather-eaters	—	—	—	—	—	—
Percentage bandy-legged	—	—	—	—	—	—
Percentage stunted i.e. birds under 2 lb. at 10 weeks	—	—	—	—	—	—
Percentage hunch-backed	—	—	—	1·9	—	—
Crooked beaks	—	—	—	—	—	—
Percentage with crooked wings	—	—	—	30·7	32·8	36·8

According to Table X no cases of feather-eating occurred in any of the groups. At the age of 10 weeks no difference in feather growth could be observed. During the first two weeks the mortality for group 3 was very high, which is ascribed to the high percentage of fibre. Up to the age of four weeks the high percentage of fibre had a very adverse effect on the average weights, as will be seen from Table VIII. After the fourth week group 3 overtook and at 10 weeks even surpassed group 2 in weight. It should be pointed out, however, that all the weak birds in group 3 died during the

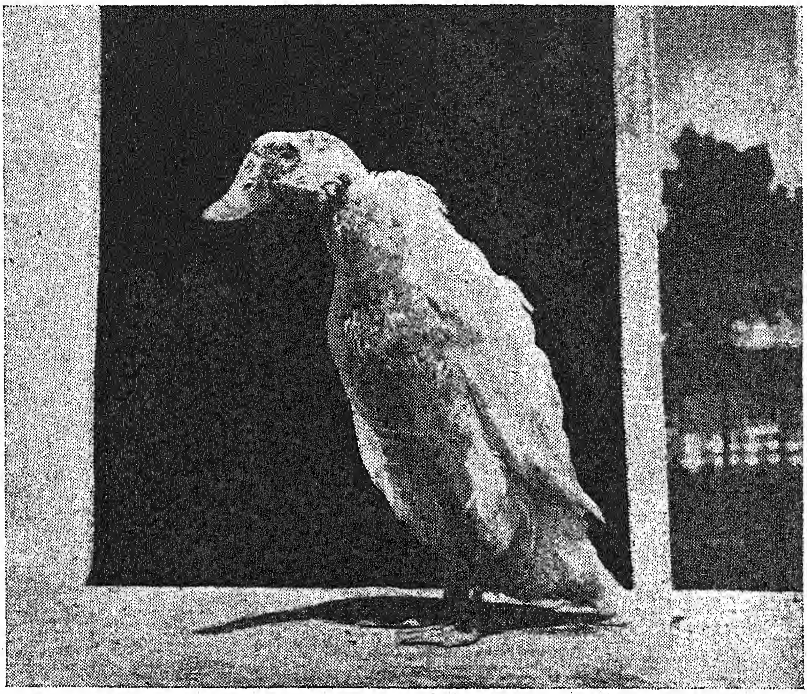

FIG. III.—Hunch-backed Pekin at age of 10 weeks with typical bent or crooked neck.

first two weeks, and that only the strongest survived. Table X further reveals that the percentage of crooked-wings for all three groups was abnormally high. Except for a single case of hunch-back in group 1, no other abnormalities occurred.

The results can be briefly summarized as follows:—

1. Cannibalism in the form of feather-eating was apparently not prevented by feeding the ration containing oatbran, since this did not occur in the case of the group fed on the ration from which oatbran was excluded. It is possible that the higher flavin or pantothenic acid content as a result of the addition of brewers' yeast and molasses had something to do with this.

2. During the first four weeks a low fibre percentage in a duckling ration is beneficial. The lowest percentage fibre fed was 2·91 and this ration produced the highest average weights at 10 weeks. Although growth after the age of four weeks was apparently not much affected by the high percentage of fibre, it would appear to be best to feed a ration low in fibre throughout the growing period.

Third Experiment: Effect of Flavin- and Pantothenic Acid on Growth and Development.

It is well known that flavin and pantothenic acid in chick rations stimulate remarkable growth and development. They also prevent the development of certain abnormalities. In order to determine what effect these two constituents have on growth in ducklings, brewers' yeast was used as a source of flavin and molasses as a source of pantothenic acid.

Three groups were formed, each consisting of 35 drakes and an equal number of ducks. Owing to their B complex content green feed and lucerne meal could not be fed; cod liver oil was therefore given in order to increase the vitamin A content of the ration. The rations and their ingredients are given in Tables XI and XII.

TABLE XI.—*Rations fed from 1st day to 10 weeks.*

Ingredients.	Rations. 1 lb.	2 lb.	3 lb.
Yellow mealie meal	55¾	57	54
Wheaten bran	10	10	10
Oatmeal	10	10	10
Fish meal (Concentra)	17¾	15¼	15½
Bonemeal	1	1	1
Oystershell powder	1	1¼	1
Brewers' yeast	—	4	4
Molasses	3	—	3
Cod-liver oil	1	1	1
Salt	½	½	½
Manganese sulphate ($MnSo_4$)	½ oz.	½ oz.	½ oz.

TABLE XII.—*Calculated constituents of rations.*

Constituents.	Rations. 1	2	3
Crude protein	19·60	19·58	19·60
Crude fibre	2·70	2·70	2·67
Calcium	1·65	1·59	1·52
Phosphorus	1·02	0·99	0·99
Vitamin G (riboflavin) Microgram per lb. feed	1044	1623	1682
Pantothenic acid per lb. feed	0·85	1·28	1·44

TABLE XIII.—*Average fortnightly weights per duck up to 10 weeks.*

Group.	2nd Week. Drakes. lb.	2nd Week. Ducks. lb.	4th Week. Drakes. lb.	4th Week. Ducks. lb.	6th Week. Drakes. lb.	6th Week. Ducks. lb.	8th Week. Drakes. lb.	8th Week. Ducks. lb.	10th Week. Drakes. lb.	10th Week. Ducks. lb.
1	0·58	0·54	1·46	1·53	2·39	2·53	3·55	3·64	4·35	4·28
2	0·75	0·82	1·85	1·98	2·83	2·89	4·25	4·16	4·76	4·51
3	1·66	0·70	2·82	1·85	3·05	3·09	3·99	4·08	4·58	4·38

TABLE XIV.—*Average fortnightly total feed consumption per duck up to 10 weeks.*

Group.	2nd Week. lb.	4th Week. lb.	6th Week. lb.	8th Week. lb.	10th Week. lb.
1...............	0·94	3·20	6·98	12·50	18·30
2...............	1·23	3·61	7·46	12·68	19·01
3...............	1·18	3·87	7·58	12·51	21·02

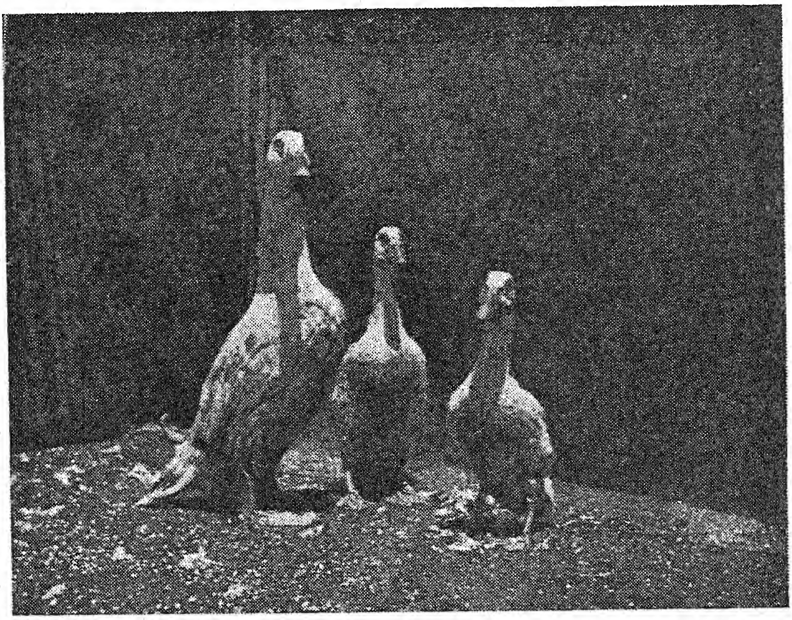

FIG. IV.—Normal Pekin weighing 5 lb. at age of 10 weeks, together with two stunted ducks of the same breed, sex and age weighing less than 2 lb. although on same ration.

TABLE XV.—*Summary of results and general data.*

Particulars.	4th Week.			10th Week.		
	Gr. 1.	Gr. 2.	Gr. 3.	Gr. 1.	Gr. 2.	Gr. 3.
Percentage mortality (original number in each group 70)............................	4·00	6·94	10·25	12·00	8·33	10·25
Average feed consumption per bird...........	3·20	3·61	3·87	18·30	19·01	21·02
Unit of feed required to gain one unit of weight	2·13	1·87	1·65	4·23	4·11	4·69
Percentage feather-eaters......................	—	—	—	—	—	—
Percentage with crooked wings..............	—	—	—	12·12	3·03	8·57
Percentage bandy-legged......................	—	—	—	3·33	—	4·28
Percentage stunted i.e. birds under 2 lb. at 10 weeks..................................	—	—	—	1·51	—	—
Hunch-backed birds..............................	—	—	—	9·09	6·06	1·42
Crooked beaks......................................	—	—	—	—	—	—

Table XIII gives the average weights up to the age of 10 weeks, the data revealing that the addition of flavin to duckling rations greatly accelerates growth and development. This increase in weight was most pronounced at the age of 4 weeks when the results were definitely in favour of groups 2 and 3. Group 1 whose ration contained a low percentage of flavin and pantothenic acid, gradually increased in weight and at the age of 10 weeks reached a weight which compared very favourably with that of the other two groups. Table XV reveals the noteworthy fact that the highest percentage and all forms of abnormality except one occurred in group 1 whose rations contained no flavin. There appears to be no great difference between the results obtained from rations 2 and 3, and the explanation for this should be sought in Table XII. Brewers' yeast is rich in pantothenic acid and, consequently, the exclusion of molasses in ration 2 did not appreciably affect the pantothenic acid content of the ration. The content apparently exceeded the minimum requirements.

The results can be summarized as follows:—

1. The flavin requirements are highest during the first four weeks of the duckling's life. The addition of this constituent in the form of brewers' yeast stimulated growth and development greatly.
2. Although abnormalities still occurred, in the case of rations supplemented with flavin, their incidence was much lower than in those cases where this constituent was excluded.

Fourth Experiment: Manganese Sulphate in Ducks' Rations and its Effect on Malformed Wings.

As has already been stated, there is some similarity between perosis in chicks and crooked wings in ducks. In the case of chicks the deformity occurs in the hock and in the case of ducklings in the wing. It has definitely been established that perosis in chicks is due to a deficiency of manganese and choline. In the experiment it was suspected that crooked wings result from some nutritional deficiency. This presumption was supported by the fact that the abnormality was also observed in Pekins, Aylesbury, khaki Campbells, muscovy ducks, muscovy × Pekin crosses and in wild geese. The latter were fed on the same rations as the ducks and cases of the abnormality occurred—conclusive proof that we are dealing with a nutritional abnormality.

It is a well-known fact that the feeding of rations containing a high percentage of maize usually results in a high incidence of perosis. Maize is low in both choline and manganese. Consequently

TABLE XVI.—*Rations fed from 1st day up to 10 weeks.*

Ingredients.	Rations.	
	1 lb.	2 lb.
Yellow mealie meal	70½	70½
Lucerne meal	5	5
Fish meal	16	16
Brewers' yeast	4	4
Molasses	3	3
Oystershell powder	1½	1½
Manganese sulphate	—	½ oz.

a ration was chosen which was known to cause a high percentage of perosis in chicks, the object being to determine whether there is any relationship between the two abnormalities. The only change made in the composition of the ration was the addition of Brewers' yeast and molasses. Manganese sulphate was excluded from one ration in order to determine whether it has any effect.

Two groups each consisting of 50 birds of each sex were used in the experiment. The rations are given in Table XVI and their composition in Table XVII.

TABLE XVII.—*Calculated constituents of rations.*

Constituents.	Rations.	
	1	2
Crude protein	19·55	19·55
Crude fibre	2·14	2·14
Calcium	1·55	1·55
Phosphorus	1·00	1·00
Manganese	11·4 p.p.m.	76·875 p.p.m.

TABLE XVIII.—*Average fortnightly weights per duckling up to 10 weeks.*

Group.	2nd Week.		4th Week.		6th Week.		8th Week.		10th Week.	
	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.	Drakes. lb.	Ducks. lb.
1	0·67	0·62	1·75	1·64	2·92	2·86	3·80	3·68	4·89	4·46
2	0·60	0·62	1·73	1·77	2·92	2·94	3·78	3·77	4·91	4·90

TABLE XIX.—*Average fortnightly total feed consumption per duck up to 10 weeks.*

Group.	2nd Week. lb.	4th Week. lb.	6th Week. lb.	8th Week. lb.	10th Week. lb.
1	0·97	3·51	7·37	13·10	17·80
2	0·90	3·46	7·54	11·20	18·05

TABLE XX.—*Summary of results and general data.*

Particulars.	4th Week.		10th Week.	
	Gr. 1.	Gr. 2.	Gr. 1.	Gr. 2.
Percentage mortality (original number in each group 50)	21	24	21	24
Average feed consumption per bird	3·5 lb.	3·46 lb.	17·80 lb.	18·05 lb.
Unit of feed required to gain one unit of weight	2·05 lb.	1·98 lb.	3·76 lb.	3·52 lb.
Percentage feather-eaters	—	—	—	—
Percentage crooked beaks	—	—	—	6·38
Percentage bandy-legged	—	—	—	2·12
Percentage stunted birds i.e. birds under 2 lb. at 10 weeks	—	—	4·44	2·12
Hunch-backed birds	—	—	—	—
Crooked beaks	—	—	—	—

The higher average weight attained at the age of 10 weeks in group 2 as reflected in Table XVIII is accounted for by the higher average feed consumption (see Table XX) rather than by the addition of manganese sulphate. According to Table XX cases of crooked wings occurred in group 1 where manganese was excluded from the ration, while 6·38 per cent. of this abnormality developed in spite of the inclusion of manganese in the ration. Cases of stunted and also of bandy-legged birds occurred in group 2. The abnormally high percentage of deaths cannot be accounted for. All these cases occurred between the fifth and tenth day. No signs of feather-eating were observed.

The results of this experiment can be summarized as follows:—

1. The addition of manganese sulphate, which resulted in the ration having a much higher manganese content than that of the control ration, did not prevent the development of crooked wings.

2. Even when the ration was low in manganese growth was normal.

Harmful Insects in Stored Winter Cereals:—

[*Continued from page 784.*

every five feet depth of grain in the container must receive a proportionate part of the dose. The carbon bisulphide can be applied direct to the surface of the grain or placed in shallow pans, after which the container must be closed immediately. The carbon bisulphide readily evaporates into a gas which is heavier than air, and therefore, effectively sinks into the grain to a depth of about five feet. The best results with carbon bisulphide fumigation are obtained if the climate is dry and hot, and the temperature above 70° F. Grain which is fumigated must be dry, and must be exposed to a maximum concentration of the gas for at least 48 hours.

This dose will not adversely affect the viability of dry grain. Grain must be fumigated immediately the primary insects are observed in it. Fumigation should, however, preferably be carried out before the onset of the wet winter months because it will then be less effective unless a hot day is selected for the work. If a loft or storeroom is fumigated with carbon bisulphide, great care against fire must be taken and a flame must not be exposed even in rooms under the loft or next to the grain storeroom, since the gas given off is also *inflammable* and may cause a fire.

Carbon bisulphide is not actually poisonous, but the fumes given off should not be inhaled unnecessarily. The gas is highly inflammable, however, and explosive, and no fire of any nature should be brought near it. The liquid itself must always be kept in an airtight container which must be stored and locked away in a safe place.

Acknowledgement.

The writer wishes to avail himself of this opportunity to express his thanks to Messrs. E. A. Back and R. T. Cotton for considerable information obtained from their publication, as well as for the use of the different illustrations which so clearly depict the structure of some of these grain insects and which have all been taken from the U.S.D.A. Farmers' Bulletin No. 1260, 1931.

Feeding of Laying Hens.

P. J. Serfontein, Professional Officer (Poultry Research), College of Agriculture, Potchefstroom.

IN the past laying rations were composed mainly of grain and grain by-products. In normal times such grains as maize, wheat and oats were used but during the last two years unforeseen circumstances have restricted the available grain and grain by-products to such an extent that poultry breeders have been compelled to simplify the composition of the ration to the limit.

In view of these shortages experiments were conducted at the Potchefstroom College of Agriculture with simple rations composed of the few ingredients still available to the average poultry farmer, the object being to determine their effect on the productivity and health of the birds.

The greater the number of ingredients included in a ration, the less likelihood is there that a deficiency of some essential nutrient might occur. All feeds differ in their composition and contain certain essential nutrients in different proportions. Yellow maize, for example, is rich in vitamin A, whereas wheat and wheaten products contain only traces of this constituent. The latter, however, are richer in the vitamin B complex than yellow maize, etc. In view of the limited number of ingredients available, it is readily understandable, therefore, that such a simplified ration will inevitably have certain limitations, in spite of the fact that it satisfies certain standard requirements.

Five groups of White Leghorns and five groups of Black Australorps were fed on the rations given in Table I. The Black Australorps were housed intensively in laying houses measuring 18 feet by

TABLE I.—*Ingredients of Rations.*

Mixture.	Group 1.	Group 2.	Group 3.	Group 4.	Group 5.
	%	%	%	%	%
Yellow mealie meal..........	19	33½	41½	24½	25½
Wheaten bran...............	20	—	—	—	—
Crushed oats................	15	10	10	10	—
Oatbran....................	—	—	—	15	15
Lucerne meal...............	10	15	15	10	10
Palm-kernel oil-cake meal.....	—	—	—	—	10
Meat and bone meal, fish meal (Concentra), groundnut meal 10: 11·8 : 14·4............	25	30	—	30	29
Meat- and bone meal.........	—	—	32	—	—
Bone meal..................	6	8	—	6	6
Oyster-shell powder..........	4½	3	1	4	4
Salt.......................	½	½	½	½	½
	100	100	100	100	100
Yellow maize (grain).........	100	100	100	100	100

TABLE II.—*Calculated Constituents of Ration Consisting of Mash and Grain in Equal Proportions.*

	Group 1.	Group 2.	Group 3.	Group 4.	Group 5.
	%	%	%	%	%
Crude fibre..................	4·31	3·85	3·89	4·72	4·91
Crude proteins..............	16·10	16·18	16·20	16·30	16·31
Calcium....................	2·28	2·32	2·15	2·30	2·31
Phosphorus.................	0·99	1·08	1·10	0·97	0·97

20 feet, and each group consisted of 41 birds. The White Leghorns were housed in separate laying batteries; each of the first three groups consisted of 40 hens and the last two of 36 each.

The grain consisted of crushed maize. Except in the case of ration 3, the protein added was derived from three sources. The reason for making use of various sources was that, as the grain ingredients were so limited, greater variety could be obtained in this way. Ration 2 differed from ration 1 in that wheaten bran was omitted, that the quantity of crushed oats was reduced owing to a shortage of this product as well, and that the percentage of lucerne meal was increased. Ration 3 was practically the same as ration 2 except that the former contained meat- and bonemeal, whereas a mixture consisting of meat meal, bone meal, fish meal and groundnut meal was added to the latter. Oatbran was added to ration 4 in order to prevent feather-eating about which there were general complaints, and palm kernel meal, a new ingredient in poultry rations, to ration 5.

In the case of the laying batteries the grain was fed in the mash hopper at midday, and green feed was given in the same hoppers once a day. One per cent. of cod liver oil was included in the mixture for the hens in the batteries. The Australorps kept in the houses were given grain in the litter at the same time as the Leghorns in the batteries were fed. From June to the beginning of September the green feed consisted of green wheat and oats, and for the rest of the time green lucerne was fed. Oystershell was fed in open hoppers in the houses, and in the case of the batteries it was provided once a week in the mash hoppers.

Apart from the various methods of housing, the groups in the houses and those in the laying batteries received the same treatment.

The experiment was commenced on 1 May, 1942, and was continued until the end of January, 1943. When the hens were placed in the different houses and in the laying battery they were all young and had just come into production. Many of them went into a moult as a result of this change in housing and feeding. In the houses the Australorp hens ware trapnested individually.

TABLE III.—*Average Body Weight.*

Month.	White Leghorns.					Black Australops.				
	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1st May (1942)..	3·82	3·78	3·86	3·85	3·86	4·69	4·74	4·75	4·77	4·70
1st July........	4·56	4·54	4·58	4·71	4·53	5·83	5·95	5·70	5·49	5·80
1st Sept........	4·64	4·43	4·75	4·26	4·65	5·71	6·04	5·68	5·55	5·41
1st Nov.........	4·31	4·44	4·50	4·27	4·20	5·44	5·69	5·25	5·40	5·15
31st Jan. (1943)	4·44	4·51	4·40	4·38	4·04	5·59	5·81	5·41	5·21	5·30

TABLE IV.—*Average Egg Production on a Hen-day Basis, Calculated for Nine Months.*

	Rations.				
	1.	2.	3.	4.	5.
White Leghorns............	150·3	147·0	145·4	134·5	129·7
Black Australops............	129·3	118·0	111·2	121·5	127·0

TABLE V.—*Average Weight per 100 Eggs.*

	Ration 1.		Ration 2.		Ration 3.		Ration 4.		Ration 5.	
	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
July..	14·07	13·89	13·58	14·28	13·63	13·54	14·05	14·29	14·15	14·44
Aug..	14·16	13·47	13·36	14·05	14·29	13·87	14·04	13·71	13·80	13·93
Sept..	14·13	13·53	13·84	14·33	13·37	13·02	13·40	13·87	13·73	14·11
Oct..	13·97	13·64	13·93	13·97	13·69	13·56	13·86	13·98	13·76	14·20
Nov..	14·40	14·53	14·25	15·31	13·93	13·88	14·38	13·95	13·78	13·75
Dec..	13·87	14·11	13·84	14·42	13·80	13·86	13·76	13·73	13·64	14·49
Jan..	13·88	14·16	13·89	14·44	13·84	13·89	13·78	13·76	13·67	14·51

TABLE VI.—*Percentage Soft-shelled Eggs.*

	Ration 1.		Ration 2.		Ration 3.		Ration 4.		Ration 5.	
	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.	Leg-horns.	Austra-lorps.
May..	0·660	—	0·710	—	2·800	—	0·800	—	—	—
June.	0·680	—	1·300	—	2·400	—	0·310	—	—	—
July..	—	—	—	—	1·400	—	—	—	—	—
Aug..	0·130	—	0·700	—	0·830	—	1·200	—	—	—
Sept..	—	—	0·390	—	1·900	—	1·100	—	—	—
Oct..	0·001	0·009	0·002	0·010	0·007	0·010	0·020	0·003	0·010	0·003
Nov..	1·200	2·000	0·400	1·800	1·600	2·900	5·040	1·300	3·200	0·900
Dec..	0·920	1·200	0·000	0·650	1·700	1·000	3·900	0·700	1·500	1·000

TABLE VII.—*Percentage Hatchability in Australorps.*

	Rations.				
	1.	2.	3.	4.	5.
Number of eggs placed in incubator......	140	109	98	94	105
Percentage infertile.....................	14·3	24·7	13·2	18·0	6·6
Percentage dead embryos...............	8·3	18·2	15·2	10·4	15·3
Percentage dead in shell................	20·8	35·3	15·2	42·8	21·4
Percentage chicks from fertile eggs.......	62·5	28·0	52·9	36·3	50·0

TABLE VIII.—*Average Feed Consumption for Nine Months.*

	Ration 1.			Ration 2.			Ration 3.			Ration 4.			Ration 5.		
	Mash.	Grain.	Total.	Mash.	Grain.	Total.	Mash.	Grain.	Total.	Mash.	Grain.	Total.	Mash.	Grain.	Total.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
White Leghorn...	47·8	21·7	69·5	40·8	22·3	63·1	41·7	22·3	64·0	38·6	22·0	60·6	39·9	22·8	62·7
Black Australorp.......	41·6	25·1	66·7	44·3	28·6	72·9	37·1	27·7	64·8	36·2	24·6	60·8	39·0	29·9	68·9

TABLE IX.—*Feed Consumption per Dozen Eggs Produced.*

	Rations.				
	1.	2.	3.	5.	5.
	lb.	lb.	lb.	lb.	lb.
White Leghorn........................	5·4	5·0	5·2	5·4	5·6
Black Australorp.......................	6·4	8·6	7·6	6·8	6·8

TABLE X.—*Percentage Mortality.*

	Rations.				
	1.	2.	3.	4.	5.
White Leghorn........................	10	2·5	12·4	0	2·2
Black Australorp.......................	4·8	10·7	12·1	12·1	10·0

Discussion of Results.

The average egg production is given in Table IV. The pronounced difference in production between the two breeds must be attributed mainly to the amount of egg-eating among the Australorps kept in the houses. Although it occurred in all five groups, groups two, three and four were the worst offenders. All eggs laid on the ground were eaten, and the position ultimately became so serious that even the eggs in the trap nests were consumed, with the result that it was not always possible to determine whether the hens had laid or not. The average production of the Leghorns can, therefore, be accepted as a more reliable reflection of their production since egg-eating was eliminated in the batteries.

In the case of the Leghorns the highest average production was obtained on ration 1 and, as might be expected, the feed consumption of this group was also the highest according to Table VIII. The lower feed consumption in the other four groups is undoubtedly to the fact that these rations were less palatable. The omission wheaten bran from rations 2 and 3 resulted in the ration being heavy and the amount of bulk which this product gives to rations was conspicuous by its absence. On the other hand, the oatbran in rations 4 and 5 gave too much bulk and a corresponding increase in the fibre content. A comparison of the quantities of feed required for the production of 1 dozen eggs (see Table IX), shows that in the case of the Leghorn groups the difference is slightly in favour of ration 2. Once again cannibalism in the form of egg-eating has made it impossible to compare the data for Australorps in the same table. The inclusion of oatbran in ration 4 and the same ingredient together with the palm kernel oil-cake meal in ration 5 had a more adverse effect on the ration than the amount of simplification effected in rations 2 and 3. Feather-eating occurred in all the Australorp groups to more or less the same extent, except in the case of ration 1, where it was only slightly discernible.

Except for ration 2 where the Australorps were inclined to produce heavier eggs, the average egg weights given in Table V are in favour of ration 1. It is noteworthy that during the hot months

January and December the Australorps in all the groups except group 4, produced eggs with an average heavier weight. The only possible explanation for this is that there might have been a difference in temperature and that the houses of the Australorps were cooler during this period.

The ingredients of the ration undoubtedly have a very pronounced effect on the formation of egg shell. The existing facilities, however, did not allow of the shell strength of the various groups being tested. Records were kept, however, of all eggs, which had such soft shells that they would either break with the slightest handling or actually did break as a result of such handling. The percentage which occurred in each group is given in Table VI. The Leghorns in the batteries laid the highest number of soft-shelled eggs, the distribution of which covered the whole test period. In the case of the Australorps kept in the houses, soft-shelled eggs were laid only during the last three months. This difference between the eggs of the two breeds must be ascribed in the first place to the system of housing and, in the second, to breed characteristics. As can be expected, many of these eggs were eaten in the Australorp groups. In the case of the Leghorn groups, ration 3 was responsible for the largest number of soft-shelled eggs and ration 4 for the second highest number. Rations 1 and 2 produced the smallest number in this respect.

If a flock of hens are to achieve a good average production, it is essential that they should not only maintain the body weight with which they commenced production, but even increase it as the production period advances. According to Table III all five of the rations satisfied this requirement. An increase in weight occurred in all the groups of both breeds. Rations 1, 2 and 3 produced the highest average weights in both Leghorns and Australorps towards the end of the test period. A further indication of the health of the birds is given in Table X which reflects the percentage mortality. These average figures in all groups of both breeds are very satisfactory. It cannot be deduced from these data that any of the rations were actually responsible for or specifically contributed towards a higher mortality than the normal average.

The number of eggs placed in the incubator (as given in Table VII) for each group was small, however. The results obtained with ration 1 were still satisfactory, but those obtained with the other four rations were decidedly poor, especially so in the case of rations 2 and 4. It was the general experience of practical poultry farmers that the simplified rations yielded poorer hatching results.

Conclusions.

The above data lead to the following conclusions:—

(1) All things considered, the simplified rations could not yield results equal to those of the control rations which contained wheaten bran, in spite of the fact that some variety was introduced by the inclusion of various sources of protein.

(2) The decrease in nutritive value of the four rations as compared with the control rations is reflected mainly in the amount of egg-eating which occurred in these groups.

(3) Poultry rations can admittedly be made up without the inclusion of wheaten by-products, but from a practical point of view the beneficial effect of these products can hardly be compensated for.

(4) Oatbran in these rations could not prevent feather-eating.

(5) Small quantities of palm-kernel oil-cake can be included in the ration.

Worms in Cattle.

WORMS in cattle are causing increasing concern, especially under the prevailing conditions, since many remedies are unobtainable and farmers from all parts of the country are asking for advice.

Both cattle and sheep are subject to infestation by the same species of liver-fluke, tapeworm and wireworm, as well as by bankrupt worms and other species of hook and nodular worms.

The symptoms of worm infestation are:—poor condition, sometimes accompanied by scours, and frequently by a watery swelling under the jaw. The swelling is not due to liver-fluke alone, as is often thought, but is a symptom of anaemia caused by liver-fluke, wireworm, hookworm and other species of worms.

Cattle generally become infested with worms when they graze in marshy spots and should therefore be kept away from such places. Good feed is an important factor in preventing worm infestation or in counteracting its effects.

When a farmer suspects that his cattle are infested with liver-fluke, it is advisable that he should first make sure that this is the case before resorting to unnecessary treatment. If it is impossible to slaughter a weak animal and search for the worms in the liver, the farmer should forward for investigation to the Director of Veterinary Services, Onderstepoort, a bottle containing about a tablespoonful of fresh dung to which an equal amount of methylated spirits has been added. Separate bottles must be used if the dung of more than one animal is sent. Further information will then be given.

Tapeworms are of importance only in calves. The ripe segments which resemble rice kernels can be seen in the dung. For treatment nodular worm remedy is recommended.

Nodular worms in cattle are not very harmful. Wire, bankrupt and hookworms are of far greater importance. The best remedies are Tetrol (or Tetram) and copper sulphate-nicotine mixture, but these are not obtainable at present. At the moment (October 1943) only nodular worm remedy is available and it also has a good effect. All three of these remedies can be administered without first starving the animals, but calves must be kept away from their mothers for 4 hours before and 2 hours after the treatment. They may, however, be allowed access to grazing and water. Before any one of these remedies is administered, the animal is first given about half-a-cup of salt water instead of the copper sulphate water which is given to sheep (1 lb. of salt in 1 gallon of water or 2 oz. of salt in 1 pint of water). The dose for nodular worm in cattle is one No. 3 spoonful for every 80 lb. live weight, but not more than 5 spoonfuls altogether. A good plan is to administer a little water after dosing in order to wash the powder down. It is desirable to repeat the treatment a few times at intervals of 2 or 3 weeks, no matter what remedy is used.

(Dr. H. O. Mönnig, Division of Veterinary Services, Onderstepoort.)

The Farm Home.

(A Section devoted mainly to the interests of Farm Women.)

I.—Cheap Cuts of Meat.

THE cheaper cuts of meat have the same nutritive value as the more expensive cuts and, if prepared in the right way, may be just as tasty.

Stewing is particularly suitable for the cheaper cuts. The meat is cut into small pieces, and pepper and salt are added to taste. If a little meal is rubbed in, this will make the gravy nice and thick. The pieces may then be fried in hot fat until slightly brown, after which they must be covered with boiling water and stewed very slowly for about two or three hours. Different kinds of vegetables may be added during the last half hour. A little sugar, lemon or vinegar improves the flavour; a little wine may also be added.

Spices and herbs, e.g., celery, parsley, thyme, coriander, nutmeg, cloves, cinnamon, ginger, etc., are very valuable for flavouring stewed meat. Also try nuts like almonds or walnuts.

If tough meat is thinly sliced, cut into squares and then pounded, this treatment will help to make the meat tender. Spread a tasty filling (e.g., chutney and bread-crumbs) over each piece, roll up, fry until brown and then stew.

Very tasty dishes can also be made with minced meat—e.g., bobotie and stuffed vegetables like tomatoes, cucumbers, onions and sweet peppers. The meat may also be wrapped in cabbage leaves previously boiled for five minutes, and then baked in a slow oven.

Musaka is minced meat cooked with vegetables. For 1 lb. of minced meat take 4 eggfruit. Cut the eggfruit into slices, sprinkle with salt and meal and fry in butter until brown. Also fry one large onion until brown and arrange in layers with the meat in a baking dish. One carrot, grated or cut into slices, and a little parsley may also be added. Beat 1 egg with ¼ pint of sour milk and pour over the dish. Bake in a moderate oven.

Pluck.—The liver, heart and kidneys are inexpensive and very nutritious. These parts should be cooked slowly at a low temperature, otherwise they always become hard, tough and dry.

Stuffing a heart.—Simmer the heart for half an hour, then slit and remove the veins. Stuff with ½ cup bread crumbs, 2 T. butter, 1 egg, 1 T. grated onion, salt, pepper and sage. Sew it up and fry until brown, then cover with boiling water and stew for 2 hours.

Kidneys.—Mix ½ c. bread-crumbs, ½ onion, ½ T. parsley, salt and pepper, and mix with beaten egg. Spread this on thin strips of bacon, which are then wrapped around sheep's kidneys and kept in position with skewers. Bake in a slow oven.

Fillings also help to make meat go further. Take the thin rib of mutton and remove the bones. Fry ¼ cup of bacon in a pan. Add 1 chopped onion, 1 tablespoon chopped parsley and celery and fry until brown. Add 5 or 6 sour cubed apples, sprinkle with ¼ cup of sugar, and fry until done. Add 1 cup of bread-crumbs and salt and pepper to taste. Other fruit like pineapples, quinces and apricots may also be used. Place the filling on top of the prepared cut of meat and then stew.

Beef á la Mode is another attractive dish. Use 3 to 4 lb. of aitch-bone or rump. Stuff the meat with strips of "spek" (lardoons). If the meat is soaked in vinegar overnight, its flavour will be improved, and it will also become more tender. Sprinkle with salt, pepper and meal and fry in fat until brown.

Place the meat in a heavy saucepan half filled with boiling water, and cook slowly for 3 hours. Then add $\frac{1}{3}$ cup each of turnips, carrots, celery, onions, a few laurel leaves and potatoes, and cook until done.

(Miss M. Dommisse, Home Economics Officer, College of Agriculture, Grootfontein, Middelburg, C.P.)

II.—Meat-Substitute Dishes.

Vegetarianism has been known from time immemorial. People who call themselves vegetarians do not eat meat in any form: some for health reasons and others because it is against their religious principles. Strict vegetarians eat no animal foods whatsoever. Those who are less strict do eat some in the form of milk, cheese and eggs.

Climatic conditions play an important part in connection with diet, especially that of a group of people. In cold climates fats and and other energy-giving foods are absolutely necessary, not only for building up the body tissues, also for supplying heat and energy. The inhabitants of very hot parts of the world, on the other hand, find a fruit and vegetable diet more beneficial, while a mixed diet of meat and vegetables is ideally suited to our temperate South African climate. Let us, therefore, assume that we are not dealing with strict vegetarians, and devote our attention to some of the most popular of our meat-substitute dishes.

Although meat is a valuable source of proteins, its excessive consumption is condemned for economic and health reasons. Meat with one meal a day is quite sufficient. For the other meals the housewife can prepare economical and nutritious dishes.

Vegetables, and especially peas, beans and lentils, constitute an ideal basis for vegetarian dishes. These vegetables are particularly rich in proteins—the nutrient which plays a part in building up body tissues.

Milk, our most important food, because of its high protein, mineral salts and fat content, constitutes a perfect supplement to such a vegetable dish.

Cheese, combined with milk and eggs, offers a welcome change in the preparation of vegetarian dishes. Since cheese is an economic source of proteins, rich in calcium and a concentrated food, it forms, like vegetables, a palatable and wholesome main item on the vegetarian's menu.

The above-mentioned essential nutrients are also found in eggs, so that an egg dish is likewise a popular substitute for meat.

Dairy products together with eggs and vegetables are, therefore, tissue-building and well-balanced foods which can be used instead of meat and are within the means of every housewife.

Selected Recipes.

Vegetable Milk Soup.

- 2 c. minced cooked vegetables.
- 2½ c. milk, or half milk and half vegetable water.
- 1 T. flour.
- 1 T. butter.
- 1 t. onion juice.
- Salt and pepper.

Heat the milk and onion juice, melt the butter and mix with the flour, salt and pepper. Add the milk and boil, stirring all the time until the mixture thickens. Add the vegetables, bring to the boil and stir in the arsley. Serve hot.

BEAN SOUP.

½ lb. dried beans.
1 onion.
A few stalks of celery.
1 T. butter.
½ pint milk.
Salt and pepper
4 pints of vegetable or clean water.

Soak the beans overnight. Chop the onion fine and cut the celery in pieces. Melt the butter and mix with the vegetables. Pour sufficient of the water in which the beans have been soaked, over the vegetables and boil until they are soft. Rub through a sieve and put the vegetable pulp back into the saucepan. Add the milk, vegetable water, salt and pepper. Boil and stir until thick enough. Serve hot with slices of toast.

BROWN VEGETABLE SOUP.

2 quarts water.
1 slice toast.
1 small cabbage.
Parsley (finely chopped).
Salt and pepper.
2 carrots.
1 turnip.
2 potatoes.
2 onions.
2 T. butter.

Fry the onions in the butter until well browned. Add the water, salt, pepper, toast and finely cut vegetables. Beans, green peas, celery, parsnips or any other kind of vegetable can also be added. Boil from 3-4 hours and rub through a sieve. Boil for another 10 minutes and serve. If too thick, add water. If the soup is too thin, boil in uncovered saucepan until the surplus water has evaporated.

LENTIL DISH.

1½ c. lentils.
2 eggs.
1 T. butter.
½ c. walnuts.
1 small onion.
1 c. dry bread-crumbs.
Salt.
Pepper.

Soak the lentils and boil until soft. Add the finely chopped onion, butter and salt, and boil for about 25 minutes in a covered saucepan. Rub through a sieve and add the other ingredients. Bake in a moderate oven for about 45 minutes.

Serve hot with vegetables or cold with a salad.

BEAN DISH.

1½ c. dried beans.
1 egg.
1 onion.
Butter.
1 T. parsley (chopped).
1½ c. grated cheese.
1 c. bread-crumbs.
1 c. milk.
Salt.
Pepper.

Boil the beans until soft, and mince. Add grated onion and mix with the other ingredients. Put in a greased baking dish and place lumps of butter on top. Cook until well done. Serve with tomato sauce.

TOMATO SAUCE.

1¼ c. tomato pulp.
Salt.
Pepper.
1 T. butter.
1 T. flour.
Sugar.

Melt the butter and mix with salt, flour and 1 t. sugar. Add tomato pulp and boil, constantly stirring until well done. Add pepper, more salt and sugar to taste.

MOCK SAUSAGES WITH APPLE RINGS.

2 c. cooked dried beans (minced).
1 t. grated onions.
Salt.
Pepper.

Mix the ingredients. If too dry, moisten with a little beaten egg. Mould into shape of small sausages, roll in dry crumbs and egg, and fry in deep fat. Serve hot with apple rings and garnish with parsley and/or slices of tomato.

APPLE RINGS.

Use sour cooking apples. Cut into rings half an inch thick and remove pips. The apples can either be peeled or left unpeeled. Fry in butter until soft, but do not break. Turn only once. This makes a delicious breakfast dish.

WELSH RAREBIT.

1 T. butter.
1 t. cornflour.
½ c. milk.
¼ t. salt.
¼ lb. finely grated cheese.
¼ t. mustard.
Cayenne pepper.

Melt the butter and mix with cornflour. Add milk and stir over boili water until the mixture begins to thicken. Remove from fire and stir cheese and seasoning. Remove from the fire and stir until all the cheese melted. Serve on slices of toast.

CHEESE DISH.

1 c. hot milk.
1 c. soft, stale bread crumbs.
¼ lb. grated cheese (preferably with strong flavour.
1 T. butter.
¼ t. salt.
3 eggs.

Mix the first five ingredients and add the well-beaten yolks. Mix well. Beat the whites of the eggs until stiff and fold into the mixture. Pour into a greased baking dish and bake for about 20 minutes in a moderate oven. Serve immediately.

MEALIE AND CHEESE DISH.

2 c. boiled fresh or canned mealies (sweetcorn is very nice).
2 tomatoes.
2 T. flour.
2 T. butter.
2 c. milk.
½ c. grated cheese.
Salt and pepper.

Melt the butter, add the flour, salt and pepper, and mix well. Add milk and boil, stirring constantly until mixture thickens. Remove from the fire. Add the cheese and stir until melted. Pack alternate layers of mealies, slices of tomato and cheese sauce in a greased baking dish. The topmost layer must be sauce. Bake in a moderate oven.

CHEESE VEGETABLE.

4 T. butter.
4 T. flour.
½ lb. cubed cheese.
2 c. boiled potatoes cut into slices or cubes.
1½ c. milk.
2 t. salt.
1 c. boiled carrots, cut fine.
1 grated onion.
1 c. boiled green peas (or canned peas).

Make a white sauce of the butter, flour, salt, milk and a little pepper, and melt the cheese in it. Place the vegetables in layers in a buttered baking dish and pour the sauce over. Bake in a moderate oven until hot.

MEALIE CUSTARD.

2 c. cooked green mealies.
2 eggs, slightly beaten.
Salt and pepper to taste.
1½ T. butter.
2 c. hot milk.

Mix all the ingredients and bake in a greased baking dish in a moderate oven until firm and done. If the baking dish is placed in a pan of warm water in the oven, the custard will have a better texture.

(Miss M. M. van Tonder, Home Economics Officer, College of Agriculture, Grootfontein.)

" Foods and Cookery ", Bulletin No. 115, *is out of print.*

Bulletin No. 237, *" Eggs and Poultry in Cookery ", which contains many useful recipes, is obtainable at* 6*d. per copy from the Editor.*

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 21 NOVEMBER 1943 No. 255

CONTENTS

* Price Review for September, 1943.

SLAUGHTER CATTLE.—Supplies were from moderate to heavy, but the demand was exceptionally keen, and prices on all markets generally rose appreciably. Ordinary primes on the Johannesburg market were 76s. 11d. per 100 lb. estimated dressed weight *on the hoof* as against 70s. 8d. in August; good mediums 72s. 11d. as against 65s. 3d., and compounds 65s. 8d. as against 56s. On the Durban market all offerings were also easily disposed of at maximum prices.

Slaughter Sheep.—Heavier supplies were present on the Johannesburg market and included a good percentage of outstanding sheep. Nevertheless prices again rose above the previous month's level. Prime merinos averaged 12·8d. per lb. estimated dressed weight, and medium merinos 10·9d. per lb. On the Durban market again offerings gradually decreased during the month and with a strong demand all slaughter sheep were disposed of practically at maximum prices. On the Cape Town market, prices were slightly lower than during the previous month. Prime merinos averaged 12·0d. per lb. as against 12·4d. for August and prime crossbreds were 12·0d. per lb. as against 12·2d. for August.

Grains.—Somewhat larger quantities of kaffircorn, dry beans and dry peas arrived during the month. Prices of kaffircorn as a result declined slightly, viz., from 24s. 7d. per bag free on rail for K.1 to 23s. 8d. per bag. Prices of dry beans, however, experienced a further slight increase.

Hay.—Cape lucerne was exceptionally scarce and averaged 7s. 4d. per 100 lb. for the month on the Johannesburg market. Transvaal lucerne was more plentiful but also sold at high prices. Teff grass as well as sweet grass were present in reasonable quantities.

Potatoes.—All markets were exceptionally sparingly supplied during the first half of the month. From thereon supplies gradually

* All prices mentioned are average.

increased and prices declined. The quality generally was good. Good quality fresh potatoes from the Transvaal Lowveld were also well represented. On the Johannesburg market average prices show a drop on that of the previous month. Transvaal No. 1, 10s. 5d. per bag in September as against 13s. 5d. per bag for August. National Mark Grade 1, Nos. 2 and 3 were 19s. 3d. and 19s. 10d. per bag respectively as against 21s. 3d. and 21s. 7d. per bag for August.

Onions.—Offerings consisted mainly of Cape onions, and as the season there was drawing to a close, consignments were very irregular. Transvaal onions did not arrive on the market yet. The result was that the supply was relatively small and prices advanced. Cape onions on the Johannesburg market were 26s. 8d. per bag as against 23s. 3d. per bag for August, and 24s. 9d. as against 21s. 4d. on the Cape Town market.

Tomatoes.—Consignements were still mostly from the Transvaal Lowveld. Larger supplies were present on the markets and prices of ordinary tomatoes dropped, e.g., on the Johannesburg market from 4s. 8d. per tray in August to 4s. 3d. in September; on the Cape Town market from 4s. 9d. to 4s. 5d. and on the Durban market from 2s. 8d. to 2s. 5d. per tray. In spite of a bigger supply National Mark tomatoes on the Johannesburg market, prices, however, advanced further, viz., from 7s. 11d. per tray in August to 8s. 5d. in September.

Vegetables.—Larger quantities of green peas, green beans, squashes and vegetable marrows came on the markets. Bigger consignments also arrived from the Transvaal Lowveld. Pumpkins, cauliflower and cabbage were scarcer and dearer.

Fruit.—A larger supply of oranges, mainly Valencias, were on the markets. An improvement in quality was especially noticeable during the second half of the month and sales were brisk. Excepting papaws, there were no other fruits present in noteworthy quantities.

Eggs.—The supply of eggs increased, but as a result of the exceptionally strong demand, prices declined little or nothing.

Index of Prices of Field Crops and Animal Products.

This index, as shown elsewhere, rose from 153 in August to 156 in September.

The most important increases occurred in—

(*a*) the group " Hay ", viz., from 175 to 182 in September.
(*b*) the group " Slaughter Stock ", viz., from 184 to 201.

The remaining groups changed very little or nothing.

Review of the 1941/42 Cotton Crop.

A CONSIDERABLE increase in the acreage under cotton had been expected, but weather conditions made this quite impossible. The first rains came very late after a very dry period and ploughing could not be started till it was already late for planting. The result was not only a smaller acreage than was intended, but also poorer crops than usual. As per ginners' returns, the total crop amounted to

341,413 lb. lint, or 710 running bales. The details compared with previous years are as follows:—

	1941-42.	1940-41.	1939-40.	1938-39.	1937-38.
Running Bales	710	1,612	1,676	604	938
Statistical Bales (500 lb.)	683	1,486	1,649	598	906
Lint (lb.)	341,413	742,902	824,514	298,853	452,790
Seed Cotton (lb.)	1,067,105	2,125,199	2,529,819	894,691	1,436,411
Seed [delinted and undelinted (lb.)]	672,348	1,307,052	1,601,898	550,334	904,455
Linters (lb.)	62,631	78,501	75,597	21,599	37,990

Production by areas, with the last two season's figures for comparison, is as follows:—

	Seed Cotton (lb.).		
	1941-42.	1940-41.	1939-40.
Natal and Zululand	132,658	497,379	772,989
Rustenburg area (including Pretoria and Marico)	18,392	194,180	147,351
Northern Transvaal (including Waterberg, Pietersburg and Zoutpansberg)	15,262	182,650	203,591
Eastern Transvaal (including Middelburg, Lydenburg and Barberton)	790,118	1,046,825	1,002,389
Southern Transvaal (Pongola River Area)	—	1,451	—
Cape Province	46,192	63,684	305,859
Swaziland	64,483	139,030	97,640

GRADING.

Comparison of Staple.	1941-42.		1940-41.		1939-40.		1938-39.	
	Bales.	Per-cent.	Bales.	Per-cent.	Bales.	Per-cent.	Bales.	Per-cent.
$1\frac{1}{4}$ inch and above	18	2·54	—	—	153	9·13	4	0·66
$1^{3}/_{16}$ inch	11	1·55	61	3·78	53	3·16	—	—
Full $1\cdot\frac{1}{8}$ inch	—	—	—	—	—	—	—	—
Good $1\cdot\frac{1}{8}$ inch	391	55·07	1,017	63·09	1,067	63·66	397	65·73
$1\cdot\frac{1}{8}$ inch	290	40·84	485	30·09	390	23·27	201	33·28
$1\ ^{1}/_{16}$ inch and below	—	—	49	3·04	13	0·78	2	0·33
TOTAL	710	100	1,612	100	1,676	100	604	100

Comparison of Grades of Good Colour Cotton.	1941-42.		1940-41.		1939-40.		1938-39.	
	Bales.	Per-cent.	Bales.	Per-cent.	Bales.	Per-cent.	Bales.	Per-cent.
Middling Fair	—	—	—	—	—	—	—	—
Strict Good Middling	36	5·07	117	7·26	199	11·87	19	3·15
Good Middling	195	27·46	281	17·43	193	11·52	19	3·15
Strict Middling	192	27·04	281	17·43	436	26·01	50	8·28
Middling	66	9·30	141	8·75	301	17·96	180	29·80
Strict Low Middling	—	—	213	13·21	212	12·65	58	9·60
Good Colour	489	68·87	1,033	64·08	1,341	80·01	326	53·98
Fair colour	—	—	8	0·50	105	6·27	10	1·66
Very light spotted	186	26·20	434	26·92	182	10·86	211	34·93
Other off-colour	35	4·93	137	8·50	48	2·86	57	9·43
TOTAL	710	100	1,612	100	1,676	100	604	100

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON (1st July to 30th June).	Summer Cereals. (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Stock. (e)	Dairy Products. (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1936-37	118	86	94	93	122	86	89	98	106
1937-38	89	106	112	118	98	112	105	107	101
1938-39	92	107	96	89	79	102	106	94	93
1939-40	86	106	77	93	116	105	106	89	104
1940-41	109	113	106	159	103	108	110	112	109
1941-42	121	132	145	205	101	131	134	163	124
1942-43	160	149	151	159	115	148	167	184	145
1943—									
January	160	154	132	113	115	139	165	150	141
February	163	154	130	112	115	139	156	179	142
March	161	154	142	119	115	139	160	216	145
April	159	154	142	140	116	139	163	262	148
May	169	154	144	155	116	163	165	316	156
June	169	154	165	165	116	163	166	202	150
July	170	154	174	186	116	176	182	185	153
August	170	154	175	182	116	184	184	172	153
September	169	154	182	184	116	184	201	171	156

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay
(d) Potatoes, sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins.
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls, turkeys and eggs.

Average Prices of Potatoes and Onions on Municipal Markets.

SEASON (1st July to 30th June)	POTATOES (150 lb.).						ONIONS (120 lb.).		
	Johannesburg.				Cape Town.	Durban.	Johannesburg.	Johannesburg.	Cape Town.
	Transvaal. No. 1.	Transvaal. No. 2.	N.M. Grade 1. No. 2.	N.M. Grade 1. No. 3.	Cape No. 1.	Natal No. 1.	Transvaal.	Cape.	Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940-41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942-43	13 7	12 6	15 8	15 11	15 0	16 9	13 8	14 0	12 6
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	15 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December	11 6	9 6	14 1	13 3	12 2	15 6	9 3	10 11	11 9
1943—									
January	7 9	6 8	10 9	10 8	10 9	14 2	8 5	9 4	7 8
February	8 3	7 2	11 8	11 6	8 4	13 7	7 10	10 9	7 8
March	8 10	8 5	13 1	12 7	8 4	13 9	8 1	11 0	7 3
April	11 5	11 1	15 8	15 0	13 0	14 7	11 6	12 10	9 10
May	12 6	12 2	15 11	15 5	15 6	16 3	16 4	15 8	13 2
June	12 11	14 1	19 9	19 0	14 6	17 9	17 3	17 4	14 3
July	16 4	15 11	21 5	21 4	18 1	18 10	17 9	20 2	16 5
August	13 5	12 5	21 3	21 7	19 0	16 3	17 8	23 3	21 4
September	10 5	11 3	19 3	19 10	20 0	17 11	26 6	26 8	24 9

Average Prices of Slaughter Cattle and Pigs.

Season (1st June to 31st May).	Beef per 100 lb.						Pigs per lb. Live Weight.		
	(a) Johannesburg.				(b) Durban.		Johannesburg.		
	N.M. Prime.	Ordinary Prime.	Good Medium.	Compounds.	Medium.	Compound.	Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938-39	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940-41	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941-42	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942-43	67 4	63 2	57 9	46 1	45 6	35 9	7·2	8·6	6·9
1942—									
January	62 3	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
October	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2
April	65 6	60 8	55 8	43 4	42 1	33 11	6·9	9·1	6·5
May	65 0	59 11	55 3	43 9	42 6	37 6	7·6	8·7	6·6
June (d)	36 3	32 7	29 7	23 1	42 6	37 0	8·3	8·7	7·4
		No. 1.	No. 2.	No. 4.					
July (d)	40 9	37 5	34 6	27 6	45 6	41 0	8·4	8·6	7·1
August	75 8	70 8	65 3	56 0	49 0	44 0	8·4	8·7	7·2
September	81 6	76 11	72 10	65 8	49 0	44 0	7·7	8·9	7·4

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.
(d) For June and July, 1943, prices were quoted per 100 lb. live weight.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

Season (1st June to 31st May).	Johannesburg.				Cape Town.			
	Merino Wethers.		Persians and Cross Breds.		Merinos.		Capes and Persians.	
	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938-39	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940-41	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941-42	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942-43	11·5	9·8	9·8	8·3	10·7	9·8	10·5	9·6
1942—								
January	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March	9·6	814	8·8	7·9	9·6	8·8	9·3	8·8
April	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
October	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·4
February	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·1
March	11·5	9·8	9·0	7·3	11·7	10·6	11·1	10·2
April	12·0	10·2	9·5	7·7	12·4	10·9	11·6	10·8
May	12·0	10·3	9·6†	7·9†	11·1	10·1	11·1	10·3
June	11·4	10·2	10·4	9·2	10·8	10·5	11·0	10·2
July	11·4	10·3	10·3	9·3	11·4	10·2	11·2	9·9
August	11·8	10·2	10·8	9·3	12·4	11·6	12·2	11·1
September	12·8	10·9	12·0	9·7	12·0	11·2	12·0	10·9

* As sold on the hoof. Reported by Meat Control Board.
† As from June "other hamels".

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

SEASON (1st July to 30th June).	EGGS. Johannesburg. New Laid, per dozen.	EGGS. Johannesburg. Fresh, per sozen.	EGGS. Cape Town, per 100.	EGGS. Durban New Laid, per dozen.	HIDES (per lb.). Port Elizabeth. 1st Grade, Sun-dried.	HIDES (per lb.). Port Elizabeth. 1st Grade, Dry Salted.	SKINS. Port Elizabeth. Merino. Medium, per lb.	SKINS. Port Elizabeth. Merino. Combings, per lb.	SKINS. Port Elizabeth. Glovers, Sound, per skin.
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938-39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940-41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941-42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1942-43	1 10	1 6	13 5	2 0	7·8	8·2	5·7	9·5	3 5
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·5	9·7	3 4
1943—									
January	1 8	1 4	13 11	2 2	8·0	8·1	5·7	9·1	3 4
February	2 3	1 11	16 7	2 7	8·1	8·1	6·1	10·5	3 5
March	2 9	2 3	19 4	3 2	7·8	7·9	5·9	10·8	3 4
April	3 3	2 9	24 8	3 11	7·8	8·7	6·3	11·1	3 7
May	3 10	3 5	29 2	4 10	7·8	8·9	5·9	10·2	3 7
June	2 3	1 10	18 7	2 9	7·9	9·2	5·7	9·9	4 0
July	1 9	1 6	16 3	2 0	8·0	9·3	5·9	9·9	4 5
August	1 8	1 5	13 5	1 9	8·0	9·3	5·8	9·3	4 5
September	1 7	1 5	11 8	1 9	8·0	9·3	5·7	8·7	4 7

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

SEASON (1st July to 30th June).	GREEN BEANS (Pocket 20 lb.). Johannesburg.	GREEN BEANS (Pocket 20 lb.). Cape Town.	GREEN BEANS (Pocket 20 lb.). Durban.	GREEN PEAS (Pocket 20 lb.). Johannesburg.	GREEN PEAS (Pocket 20 lb.). Cape Town.	GREEN PEAS (Pocket 20 lb.). Durban.	CARROTS (Bag). (a) Johannesburg.	CARROTS (Bag). (a) Cape Town.	CARROTS (Bag). (a) Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 [illegible]
1940-41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	11 4
1941-42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942-43	3 1	4 3	3 0	3 3	2 10	3 9	5 1	8 9	13 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 6
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	19 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 6	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 9	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	6 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10
1943—									
January	1 9	3 3	3 5	2 4	6 9	4 7	3 9	5 1	11 3
February	2 5	4 4	3 10	4 8	5 9	5 1	6 0	6 5	11 4
March	2 8	3 1	1 6	6 7	4 5	3 10	7 9	4 0	19 1
April	2 0	2 2	2 3	5 1	3 0	2 8	8 1	6 10	23 11
May	2 11	4 11	2 11	5 11	4 8	5 2	8 5	11 1	16 10
June	6 5	4 0	4 7	6 5	5 1	9 3	9 1	13 4	18 7
July	9 0	10 1	7 2	4 6	5 9	5 10	11 9	16 1	17 10
August	5 2	6 11	6 11	4 10	5 4	4 7	13 3	14 6	21 0
September	5 3	7 7	4 11	4 7	5 2	3 4	10 10	13 4	21 2

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

Season (1st July to 30th June).	Cabages (Bag). (a)			Cauliflower (Bag). (a)			Tomatoes (Trays 15 lb.).			
							Johannesburg.			
	Johannesburg.	Cape Town.	Durban.	Johannesburg.	Cape Town.	Durban.	N.M. No. 1.	Other.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940-41	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941-42	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1942-43	5 6	5 11	9 1	5 0	5 9	7 6	3 4	1 10	2 1	2 7
1942—										
January	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
September	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
October	4 2	6 10	2 5	—	4 9	5 5	2 6	1 5	2 0	1 4
November	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10
December	3 11	7 10	3 2	—	4 0	—	3 8	1 10	3 0	2 4
1943—										
January	5 1	9 0	12 6	—	—	—	4 11	2 4	2 6	2 8
February	6 4	10 2	15 2	5 7	5 8	—	5 5	2 7	1 8	2 11
March	5 6	9 6	8 6	6 6	5 11	—	3 11	1 9	1 10	2 7
April	4 1	9 5	8 1	3 2	6 1	7 4	3 4	1 7	2 2	3 1
May	4 5	6 0	7 9	3 10	5 0	7 0	4 10	2 6	2 3	2 6
June	7 6	5 5	12 8	8 7	6 1	11 11	7 2	3 8	4 0	3 6
July	10 4	6 7	11 1	8 5	5 3	11 0	7 11	4 5	3 10	2 1
August	12 4	6 8	11 6	7 1	5 5	10 8	7 11	4 8	4 9	2 8
September	17 0	6 8	11 8	14 5	6 8	13 5	8 5	4 3	4 5	2 5

(a) Weights of bags vary, but on the average are approximately as follows: For cabbages: Johannesburg, 105 lb., Cape Town 105 lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 65 lb., and Durban 85 lb.

Average Prices of Oranges and Pawpaws

Season (1st April to 31st March).	Oranges (Pocket).							Pawpaws (Standard box).	
	Johannesburg.			Cape Town.		Durban.		Johannesburg.	
	N.M. Navels.	Other. Navels.	Other. Valencias.	Navels.	Valencias.	Navels.	Valencias.	N.M.	Other.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 10	1 6	1 5	2 0	2 1	—	—	2 0	1 7
1940-41	1 9	1 7	1 6	1 11	1 10	2 4	2 1	2 2	1 9
1941-42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1942-43	2 4	2 6	3 1	1 11	3 9	2 8	2 11	2 7	2 1
1942—									
January	—	2 6	3 8	2 10	4 7	—	3 11	3 3	2 1
February	—	3 11	4 5	4 7	6 10	3 9	5 8	6 4	3 3
March	—	3 7	2 11	6 6	5 10	4 3	5 6	4 1	3 1
April	2 1	2 0	1 10	3 4	5 0	3 4	2 6	4 0	3 1
May	2 4	2 3	2 1	2 3	2 3	2 6	1 2	3 8	3 1
June	2 3	2 3	1 9	2 1	—	2 6	1 11	2 11	2 5
July	2 5	2 5	1 11	2 1	—	2 8	1 0	2 8	2 2
August	2 11	2 8	2 3	3 0	2 4	3 6	2 4	2 2	1 8
September	2 5	3 3	2 3	3 4	2 2	4 0	2 6	2 1	1 6
October	2 9	2 11	2 7	5 1	3 1	3 7	2 11	2 4	1 9
November	—	3 6	4 0	6 11	3 7	4 6	3 6	3 1	2 6
December	—	3 1	3 8	2 11	4 3	—	4 2	3 5	2 1
1943—									
January	2 0	3 8	4 0	—	4 10	2 4	3 9	3 9	2 0
February	7 1	5 8	5 3	—	7 6	—	4 9	4 11	3 6
March	5 11	5 4	4 1	6 6	8 6	3 3	5 8	5 2	3 9
April	3 4	2 11	2 10	5 3	4 9	3 3	4 0	4 4	3 3
May		2 4	2 0	2 8	2 0	2 4	—	4 1	2 11
June	2 6	2 4	1 9	2 6	—	2 7	—	3 9	2 9
July	—	2 5	1 9	2 5	—	2 6	2 5	3 2	2 4
August	—	2 6	1 11	—	—	2 6	2 5	3 4	2 1
	Gr. I.	Gr. II	Gr. II						
September	3 1	2 10	2 2	—	—	2 7	2 6	3 3	2 4

Average Prices of Maize, Kaffir-corn and Dry Beans per 200 lb.

Season and Month.	Maize. F.o.r. Producers' Stations. No. 2. Bags.	Maize. F.o.r. Producers' Stations. No. 2. Ex Elevator.	Maize. F.o.r. Producers' Stations. No. 6. Bags.	Maize. F.o.r. Producers' Stations. No. 6. Ex Elevator.	Maize. Cape Town Consumers' Price F.o.r. No. 6 in Bags.	Kaffircorn F.o.r. Producers' Stations. Bags, K. 1.	Kaffircorn F.o.r. Producers' Stations. Bags, K. 2.	Dry Beans Johannesburg (Municipal Market). Speckled Sugar.	Dry Beans Johannesburg (Municipal Market). Cow Peas
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	8 7	8 6	8 6	8 8	13 2	13 1	12 9	25 0	16 9
1940–41	9 2	8 8	9 3	8 9	14 0	15 6	17 0	30 0	16 8
1941–42	10 10	9 10	10 4	8 11	14 3	18 10	19 6	32 10	19 8
1942–43	15 1	—	15 1	—	18 1	24 10	24 10	34 0	25 8
1942—									
January	11 0	10 1	10 10	9 4	14 9	21 5	22 3	34 4	21 9
February	11 0	—	11 0	—	14 8	21 11	22 11	32 7	20 11
March	10 6	—	10 6	—	14 9	20 2	21 1	30 10	19 2
April	10 6	—	10 6	—	14 10	18 5	18 9	32 6	25 5
May	15 0	—	15 0	—	15 6	20 8	20 8	32 8	26 4
June	15 0	—	15 0	—	17 6	21 11	21 11	33 5	26 5
July	15 0	—	15 0	—	17 7	21 8	21 8	33 7	24 8
August	15 0	—	15 0	—	17 8	22 10	22 10	36 7	27 2
September	15 0	—	15 0	—	17 7	24 6	24 6	38 1	28 4
October	15 0	—	15 0	—	17 9	24 8	24 8	39 0	27 6
November	15 0	—	15 0	—	17 10	25 0	25 0	38 6	27 1
December	15 0	—	15 0	—	17 11½	25 0	25 0	37 3	22 7
1943—									
January	15 0	—	15 0	—	18 6	27 3	27 3	33 7	21 4
February	15 0	—	15 0	—	19 2	34 2	34 2	30 1	22 8
March	15 0	—	15 0	—	19 6	29 6	29 6	34 8	26 3
April	15 0	—	15 0	—	—	21 7	21 9	35 7	27 1
May	16 0	15 3	16 0	15 3	—	21 8	21 8	41 6	28 3
June	16 0	15 3	16 0	15 3	10 3	21 4	22 1	42 1	28 7
July	16 0	15 3	16 0	15 3	19 3	24 6	25 6	46 9	29 9
August	16 0	15 3	16 0	15 3	19 3	24 7	25 5	53 11	33 0
September	16 0	15 3	16 0	15 3	19 3	23 8	24 4	55 6	34 6

Seasonal year for maize and kaffircorn, 1st June–31st May; for dry beans, 1st April–31st March.

Average Prices of Apples, Pears and Grapes on Municipal Markets.

Season (1st July to 30th June).	Apples (Bushel box). Johannesburg. O'henimuri.	Apples. Johannesburg. White Winter Pearmain.	Apples. Johannesburg. Wemmershoek.	Apples. Cape Town. O'henimuri.	Apples. Cape Town. White Winter Pearmain.	Apples. Cape Town. Wemmershoek.	Pears (Bushel box). Johannesburg. N.M. No. 1	Pears (Bushel box). Johannesburg. Other.	Grapes (Tray). Johannesburg. Johannesburg.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938–39	7 2	6 0	5 10	7 3	8 0	4 3	6 7	4 2	1 3
1940–41	8 4	7 1	6 4	8 11	10 8	5	8 11	6 3	1 8
1941–42	8 11	7 11	7 3	9 1	10 9	6 9	7 3	8 0	1 11
1942–43	14 9	11 6	9 1	10 8	12 11	6 11	—	10 8	1 10
1942—									
January	—	—	—	—	—	—	—	7 5	3 2
February	8 3	—	12 2	8 10	—	—	7 3	7 8	1 6
March	7 5	6 11	7 6	7 7	9 3	6 3	5 6	7 0	1 10
April	8 6	7 6	6 8	7 9	9 8	6 2	—	9 6	1 11
May	8 10	7 7	6 5	8 9	9 7	5 6	—	8 11	2 0
June	10 1	8 10	8 4	8 7	10 9	6 3	—	15 9	2 5
July	11 2	11 4	8 1	10 10	12 1	8 11	—	—	0 10
August	17 6	15 8	10 6	11 7	11 8	9 10	—	—	[illegible] 5
September	16 4	16 3	7 0	11 11	11 3	—	—	—	[illegible] 1
October	16 6	16 3	—	9 11	9 4	—	—	—	[illegible] 10
November	20 8	18 6	—	10 4	7 2	—	—	—	[illegible]
December	19 7	17 8	—	11 10	17 5	—	—	14 10	[illegible] 3
1943—									4
January	—	17 5	—	11 5	—	—	—	9 8	2 1
February	10 1	11 0	14 4	8 11	9 0	4 11	—	9 10	1 11
March	8 5	10 1	8 10	9 2	11 8	5 9	—	10 0	2 10
April	13 10	10 6	11 7	10 4	12 2	6 11	—	12 8	2 7
May	16 8	11 11	12 5	12 0	13 0	8 0	—	14 8	2 10
June	18 3	17 1	12 8	14 1	16 5	13 1	—	—	3 0
July	17 3	19 7	—	12 6	17 2	14 0	—	—	— 2
August	19 5	18 10	13 3	13 10	17 9	—	—	—	8 —
September	19 5	21 10	11 4	12 6	19 1	7 7	—	—	15 [illegible]

CONTENTS

[*Photo on Cover: S.A.R. & H.*]

[NOTE.—Articles from *Farming in South Africa* may be published provided acknowledgment of source is given.]

Horse Improvement Scheme "B" (Farmers).

SERVICE SEASON 1943–44.

During the service season 1 October 1943 to 15 January 1944, the following stallions will stand at stud for service of farmers' mares at the undermentioned Institutions:—

1. College of Agriculture, Grootfontein, Middelburg, C.P.: Percheron.
2. College of Agriculture, Glen, O.F.S.: Percheron and Thoroughbred.
3. College of Agriculture, Potchefstroom: Percheron, Thoroughbred and Donkey Jack.
4. College of Agriculture, Cedara, Natal: Percheron.
5. College of Agriculture, Stellenbosch-Elsenburg: Percheron.
6. Veterinary Research Station, Ermelo, Tvl.: Percheron and Thoroughbred.
7. Pretoria University, Pretoria: Percheron.
8. Dohne Experiment Station, P.O. Dohne: Percheron.
9. Oakdale School of Agriculture, P.O. Riversdale: Percheron.

The Pretoria University will accept a limited number of mares under Scheme B for the Percheron stallion maintained there. Only mares on heat will be accepted, and in no cases can they be kept longer than three days, at 1s. per day.

The main features of the Scheme are:—

(*a*) A dourine free certificate must be submitted with the application and farmers should have their mares tested early.

(*b*) Only halter-tame mares and jennies of approved type and in satisfactory condition will be accepted—mares standing 14 hands and over and jennies 13 hands and over.

(*c*) Railway charges are charged for the forward journey only.

(*d*) The service fee is £1. 1s. and maintenance costs are 2s. 6d. per week. An additional charge of 1s. per day is made for stabling if desired and available.

Full particulars of stallions and a copy of conditions of the Scheme are obtainable from every stud station.

Juveniles and Holidays on Farms.

THE East Rand Juvenile Affairs Board has since its establishment made several efforts to encourage boys and girls in urban areas to become more interested in farming.

The war has created circumstances as a result of which many parents on the Rand cannot send their children to suitable holiday resorts during the school vacations, and as many farmers complain of the shortage of farm labourers, the Board will only be too pleased to assist juveniles to spend a pleasant holiday in the open air, and at the same time remedy as far as possible the labour difficulties confronting farmers to-day.

In order to render this dual service the Board will be glad to hear from farmers who are prepared to accommodate one or more lads of between the ages of sixteen and eighteen years on their farms during school holidays.

The Board will select suitable candidates for the vacancies offered and the persons concerned will have to make their own arrangements for the journey.

Further information will, on application, be furnished by the Secretary, Mr. B. J. Nienaber, 29 Rothsay Street, Benoni.

FARMING IN SOUTH ... AFRICA

Vol. 18 DECEMBER 1943 No. 213

Editorial:

Land Service.

LAND SERVICE is, as the term indicates, the rendering of free services to the country in the execution of valuable and important duties which are to the benefit and advantage of the community as a whole, and which are performed out of love for one's country and nation. Its achievement can therefore best be effected by an organized movement. The Department of Agriculture and Forestry feels that the time has arrived when the nation should be made more national service-minded, and that existing individual and disunited attempts in this direction should be co-ordinated into one powerful movement, the main object of which is to organize those interested into one coherent body, and to provide them with expert advice in the choice and execution of essential duties which will benefit the community as a whole. Land service places the welfare of the country and nation above personal and domestic interests. It does not by any means supplant the latter, but brings into greater prominence those interests which are of vital importance to every individual and family.

Land service is nothing new. In America it has for years been rendered by the "Civil Conservation Corps", in England by the "Labour Service", and in Germany by the "Arbeitsdienst", etc. In South Africa no body has hitherto devoted special attention to this type of service, but certain organizations like agricultural clubs, Toc H, Rotary Clubs, the Oxford Group, the S.A. Federation of Women, the Boy Scouts, Girl Guides, Voortrekkers, students, etc., have nevertheless interested themselves to a lesser or greater extent in this kind of work, and are still doing so. A few examples of work being done in this direction may perhaps be appropriate. During various camp meetings young members of the Oxford Group movement, for example, have taken a very active part in the eradication of poisonous plants, burweeds and other noxious plants on farms, and the control of erosion by constructing dams, etc. They carried out the work at their own expense, and with their own hands, and were assisted by the persons concerned. Agricultural clubs throughout the Union have done similar work, and in certain parts have eradicated pests like rats and ants, planted thousands of trees, etc. In Illinois (America) young people took a hand in the control of malaria by spraying used motor oil on all marshes and stagnant pools. All this was done without payment and at their own expense. Land service, therefore, demands sacrifice, devotion, love and a zest for work. It also entails a sense of responsibility towards one's country and nation. This service is rendered in the interests of young and old alike, and that is why all should co-operate.

Agricultural clubwork is an organized system of instruction for European children between the ages of 10 and 20 years. The movement already has 30,000 members, and publishes its own journal "Pro Patria". This movement, which is educational, places the

interest of home and hearth before all else. Under expert guidance the members learn through personal experience the best methods of doing things for themselves. The movement fosters perseverance, co-operation, sacrifice, independence and a sense of civic responsibility. The principles of leadership and obedience to such leadership are also strongly inculcated. Land service can therefore be regarded as advanced agricultural clubwork among all young people above the age of 18, whether they are male or female, townsmen or countrymen. Just as the agricultural club movement has an immeasurable influence on, and is an inspiration to, those in the neighbourhood of the clubs, so too will the national service movement radiate inspiring encouragement to the whole community, and especially to those in whom a sense of devotion to country and nation has already begun to wane. Briefly, therefore, the aim of land service is:

(i) To organize all those interested into a solid body through which their united efforts can be co-ordinated;

(ii) To focus attention especially on the most essential and most important work awaiting execution;

(iii) To extend and develop the sense of responsibility in young people so that love for their country and people might grow and thrive, and to rouse and inspire those who are not yet interested to put the shoulder to the wheel;

(iv) To encourage the youth to assist in bringing about a lasting improvement in all agricultural practices and possibilities by endeavouring to preserve, safeguard and improve soil fertility, especially since the most important problems almost throughout the world to-day are of an agricultural nature.

A Land Service Society is organized in the following way:

All those in a particular neighbourhood who are interested in the matter, come together, choose their own committee and register with the Department of Agriculture and Forestry as a National Service Society. They will then be guided by expert officers in all their efforts to carry out valuable essential works. For the rest, this system will function in the same way as agricultural unions or the agricultural club movement.

There are many tasks, mainly of an agricultural nature, which await execution, but among the most urgent are undoubtedly: (i) the control of soil erosion; (ii) the conservation and improvement of soil fertility; (iii) the collection of bones to increase bonemeal production; (iv) assistance to farmers during harvesting time; (v) the improvement of domestic practices, etc., and (vi) the promotion of valuable industries.

The aim is also to solicit the co-operation of other bodies, and to co-ordinate all similar efforts. It is not the intention to compete with our labourers on the open labour-market, but rather to pave the way for them to additional, larger, better and more useful spheres of labour. The future must be assured by, where necessary, the improvement, thorough management and conservation of the soil... that South Africa will be a good and secure home for posterity. ... or will be a task for both sexes, both young and old. ...eir

According to the leading authorities in and outside this cour... the fertility of our soil—the humus or arable soil—is not only ...ies in comparison with that of other countries, but is also ra...wn deteriorating. It is not sufficient to enrich our country with irriga... works if exploitational cropping, over-stocking and soil piracy the... tinue to be freely practised. The task of making the nati...

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A New Sweet Sorghum Variety.

F. X. Laubscher, Research Officer, College of Agriculture, Potchefstroom.

THE only varieties of sweet sorghum known to the seed trade in this country are the so-called ambercane types, the red and black varieties of which are to a certain extent grown for silage purposes. These types are comparatively vigorous growers, but, on the other hand, generally give poor yields of plant material. In 1934-35 a number of indigenous sorghums were collected and grown at this institution, and it soon became apparent that some of the material included remarkable types. By way of selection, certain lines were isolated, propagated by self-fertilization and their yield capacity and other agricultural properties determined in comparative tests.

One of the most promising sweet sorghum selections was obtained from material collected near Haakdoorn in the Potgietersrust district. This selection most closely resembles the *Sorghum nigricans* group, i.e., it is related to the varieties known in the United States as Sumac, although it can readily be distinguished from the latter in that the ear is more oblong in shape and slightly loose, and the grains are not a reddish brown but an irregular light brown colour. The grains are also less spherical and somewhat flattened. (The differences are shown in the accompanying illustration.)

In 1938 this type was cultivated for the first time in a variety trial under the name of Haakdoorn. The following table reflects the yield of plant material in tons per morgen as compared with the popular Red Ambercane during three consecutive years.

	1938–39.	1939–40.	1940–41.
Haakdoorn	46·4	31·2	41·7
Red Ambercane	34·1	18·6	29·5
Average for all varieties	39·4	25·2	34·8
Smallest significant difference	4·4	3·3	1·6

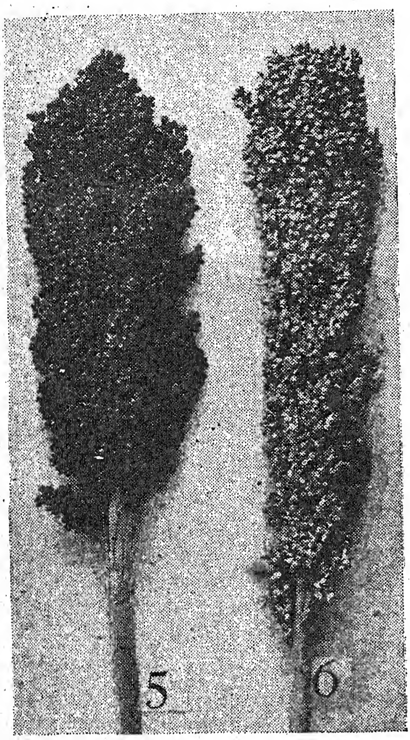
The number of varieties used for the trials varied from 7 to 13 in different years, and the average spacing was 3 feet by 18 inches. Every year 400 lb. of superphosphate was applied per morgen.

In 1938 the different varieties were also tested for succulence and sugar content. Although the stems of ambercane yielded 57·0 per cent. sap as against 50·3 per cent. by Haakdoorn under identical pressure, the sap of the latter contained almost 60 per cent. more sugar. The sugar content for the two varieties was 7·50 and 12·47 per cent., respectively. It is a well-known fact that the sugar content of the sweet sorghums is not a constant varietal characteristic and shows considerable fluctuations from year to year, but the above-mentioned figures nevertheless give an indication of the relative [illegible]its of the two varieties in this respect.

The Haakdoorn variety requires a longer growing period than ambercane, and in the 1940-41 season it evinced a tendency to lodge, [illegible] a severe drought during autumn, although it was not much [illegible] than most of the other varieties. In 1940 a quantity of the [illegible] this variety was supplied to the Sannieshof School Farm for

testing out under western Transvaal conditions, and after three years' cultivation the Principal, Mr. G. F. Combrink, reports as follows:—

"As regards the Haakdoorn variety, I am convinced that up to the present we have no better silage crop for the western Transvaal; at any rate, in so far as our School Farm is concerned, I will confine myself to the cultivation of this variety in future. This was the third year in which I grew this sweet sorghum variety on a comparatively large scale for our institution, about 22 morgen being planted to the crop. Of this I cut and ensiled about 16 morgen, and at very conservative estimate the yield obtained was 320-350 tons of silage.



No. 5—Sumac. No. 6—Haakdoorn.

I planted the seed during the second half of November in rows about 2 ft. 3 in. apart, and in an almost continuous line in the rows. Superphosphate was applied at the rate of one bag per morgen. The plants were ready for ensiling at the beginning (the first week) of April which is a very convenient time for us. The year before I planted at the beginning of December and cut towards the middle of April.

This sweet sorghum grows very well and admirably withstood the drought during February, showing that it is more resistant than maize.

We experienced no trouble with plants falling over, provided they were planted close together; only in the case of a few morgen which I had planted for seed purposes in rows six feet apart, did the plants show a tendency to lodge when they started reaching maturity. I am convinced after three years' experience that the danger of lodging can be eliminated by close planting.

Regarding the quality of the silage, all I can say is that during the past seven years I have tried out other crops like maize, kaffir corn, ambercane, etc., on the School Farm and that not one of them comes anywhere near this variety of sweet sorghum, both as regards nutritive value and palatability. My dairy cows, oxen and other stock have never been in such good condition as they are this year. In so far as I am concerned, I shall in future concentrate on the cultivation of Haakdoorn as a silage crop."

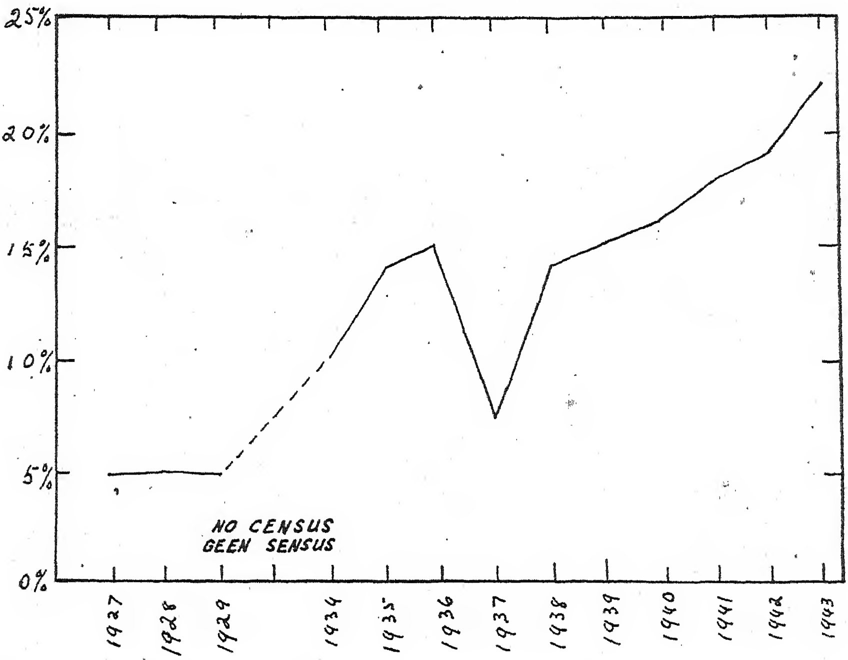
It is indeed gratifying that this variety is well suited to the western Transvaal, because here the cultivation of silage crops for feeding stock in times of drought is an urgent necessity. As a group the sorghums do well in this area and can be depended upon owing to their resistance to drought. General instructions on the

 [Continued on page 856.

Is there a Future for Merino Sheep Farming in the Southern Free State?

J. C. de Klerk, Sheep and Wool Officer, College of Agriculture, Glen.

IT is with hesitation that this question is asked since it seems to imply that the area concerned is losing its economic value as a merino sheep region. A closer examination of what is taking place will show, however, that the question appears justified. For this reason a few facts are reviewed here for careful consideration.



Percentage non-woolled sheep of total number of sheep kept.

1. Vegetation.

A gradual change is taking place in the composition of the vegetation of the southern Orange Free State. Until recently the veld in this area was densely overgrown with *Themeda triandra* or redgrass as it is commonly known. To-day, however, we find that Karroo plants are encroaching upon the veld to an ever increasing extent and that the red grass is gradually disappearing as a result of uncontrolled grazing and overstocking. At first farmers welcomed the better types of Karroo shrubs because their resistance to drought and capacity to carry stock throughout the winter were widely known. The denudation of ridges, hills and slopes of their natural grass cover, however, and their subsequent invasion by Karroo vegetation has resulted in a gradual increase in surface and donga erosion because the shrubs cannot effectively check the excessive run-off from the denuded patches after a heavy downpour.

Even the good Karroo vegetation, however, could not stand up to the heavy demands continually made upon it and was ousted in turn by "bitterbos" and "kortbeen-steekgras" (*Aristide congesta*). "Bitterbos" (*Chrysocoma tenuifolia*) not only causes poisoning among stock when ingested in large quantities, but, like "steekgras" also has a very low nutritive value. In fact, both are nothing more than pioneer plants intended by nature to protect the soil from complete denudation, and not to serve as grazing. The vegetal cover of this region, has therefore changed from red-grass to "steekgras" and "bitterbos", the process being accompanied by ever increasing soil erosion.

2. Sheep.

Owing to the higher nutritional requirements of the Merino, which must produce both mutton and wool, as well as maintain itself, the numbers of this breed are slowly declining, in spite of the very favourable prices realized for wool and hamels during the past year. Merinos are being replaced by Capes and other non-woolled sheep. In view of the remunerative prices obtained for wool during the past few years, something must be radically wrong if wool sheep are replaced by non-woolled sheep in a recognized woolled-sheep area. The percentage of non-woolled sheep of the total number of sheep kept is indicated by Fig. 1, taken for 13 districts in the southern Orange Free State.

From fig. 1 it is clear that in the pre-depression years non-woolled sheep formed only 5 per cent. or one-twentieth of the total number of sheep kept while 15 years later this figure had increased to 22 per cent. or nearly one quarter of the total number of sheep kept.

3. "Steekgras."

The evils of "steekgras" in Merino wool are only too well known: it is mainly the wool on the legs, underbody, neck-front and face which is affected. In these parts the whole fleece becomes densely packed with "steekgras", and not only does such wool often fall out but its market value is also seriously reduced. Furthermore, the seeds even penetrate the skin, causing abscesses and intense irritation which must inevitably affect the condition of the sheep. If, in addition, the animals are also infested with parasites and must suffer from lack of adequate pasturage, etc., it is by no means surprising that during some years the mortality is as high as 30 per cent. and that the average annual loss is nearly 15 per cent.

As a result of the difficult conditions under which sheep are kept, the percentage ewes which lamb every year is very uncertain and the average lamb percentage lower than in previous years. Farmers who formerly obtained a lamb-crop of 80 per cent. or more, now get as low a figure as 60 per cent. and in many cases still less.

From the foregoing it must therefore be concluded that many farmers are already finding it increasingly difficult to make a living out of Merino farming. It must immediately be admitted that nature is undoubtedly getting rid of what she cannot carry. The question which, therefore, arises, is: to what extent can the position be remedied if it can indeed be remedied?

Recommendations.

In a word the remedy lies in *improved methods of veld management.*

Numbers of merino and non-woolled sheep.

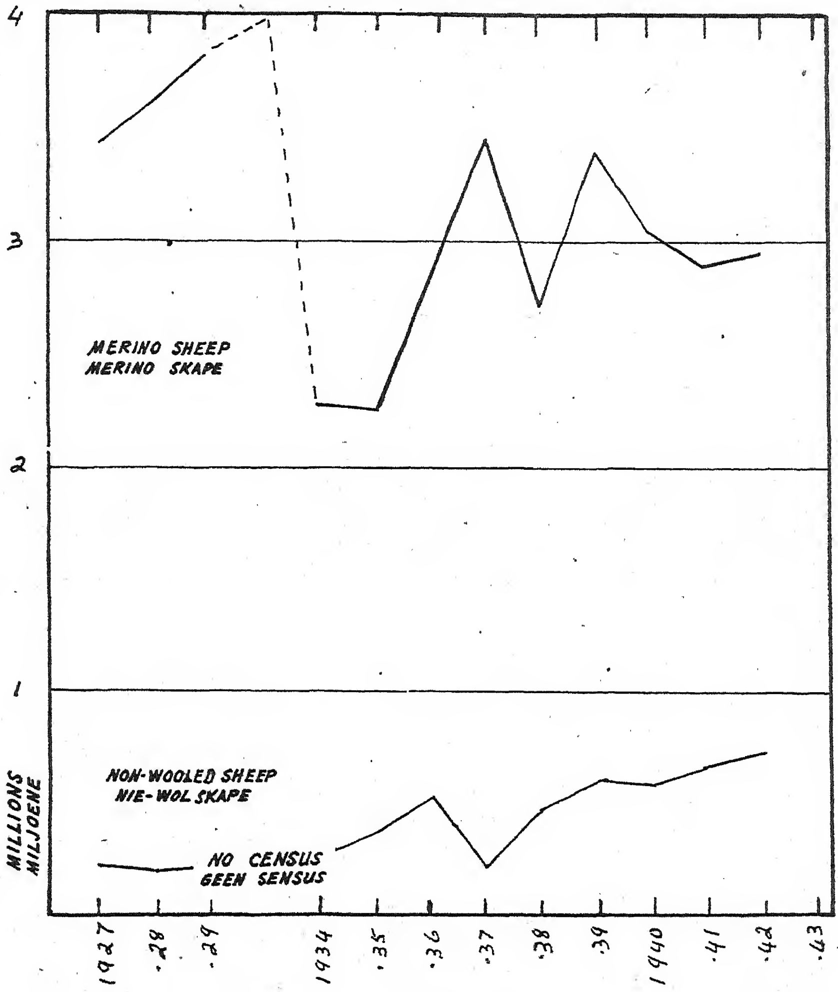


Fig II

The first and most important requirement is that the natural grass cover on ridges and slopes should not only be protected but that it should also be encouraged to the fullest extent by judicious grazing. Such treatment will not only safeguard the soil against erosion, but will also help to solve the problem of moisture conservation which is one of the most important questions in South African farming to-day.

It does not matter so much if vleis or quite level land is covered with good Karroo vegetation since the plants do not have to check erosion in such places. The trouble starts, however, where the water runs off rapidly without anything to impede its flow. In such places the grass must be strongly encouraged by leaving it undisturbed during the early stages of growth. If climatic conditions are favourable, grass can be grazed in mid-summer, but from February to March it should be rested in order to give it a chance to run to seed for further natural propagation. This rest is also essential for the recovery of plants which have been grazed, and for clearing

camps of worm infestation. The veld may be grazed again during winter, but after the first spring rains the animals should be removed.

Unfortunately, so many camps on farms are incorrectly laid out. Years ago when inside camps were made, the only considerations were the convenience of the farm management and ready access to drinking water. No attention, or very little at any rate, was given to the type of veld and consequently we find so many camps which include ridges and vleis or level land. Although it may be a very drastic measure, it is essential that many fences be broken down and re-erected so that hills and slopes are separated from flat country. It is fully realized that suitable drinking places will be a serious problem. Circumstances demand, however, *that something be done*, and on many farms the position may be considerably improved by drilling extra bore-holes, supplemented with earthern dams, where necessary.

Selective Grazing and the Ratio of Cattle to Sheep.

Veld deterioration on grassveld farms is due not only to overstocking, etc., but also to selective grazing. We know that sheep are much more particular about choosing the plants they like, and that they graze the grass much shorter than cattle.

To graze veld uniformly, therefore, it is necessary in the first place that the farm should not be overstocked and, what is equally important, that the ratio of cattle to sheep should be correct.

Take, for example, an actual case of a farm 1,000 morgen in extent on which the farmer keeps 1,000 sheep and 70 cattle. Assuming that 7 sheep are equivalent to one head of cattle, this amounts to 1490 sheep units for the whole farm, or 1·5 sheep-units per morgen and a ratio of cattle to sheep of 1:14. Suppose the farmer should decide to reduce the number of cattle to 30 and to keep more sheep. This means that he can keep 1280 sheep which will again amount to 1490 sheep units for the whole farm or a carrying capacity of 1·5 sheep units per morgen, but now the ratio of cattle to sheep will be 1:22. This increased number of sheep will, however, now make much heavier demands on the sweet grasses, while there will not be enough cattle to graze down the sour grasses equally severely. The result will be that the latter have a much greater chance of recovering and increasing at the expense of the sweet veld. The farmer will therefore be obliged to burn such veld for early spring pasturage and to get rid of the inferior grass cover.

A visit to a large number of farms (37), where the carrying capacity was correlated with the ratio of cattle to sheep, showed that the best grassveld farms were those with a cattle-sheep ratio of 1:13 to 15. Incidentally, it must be mentioned that, except for small patches here and there which are burnt occasionally, veld-burning is not practised on these farms. On many other farms with much poorer veld, veld burning is carried out systematically and regularly. As the veld became more broken, the ratio, as can be expected, also became wide, namely 1:23 or more, and even 1:43 where the veld had become predominantly good Karroo veld. We are therefore strongly convinced that the ratio of cattle to sheep in the grassveld areas of this region should not be greater than 1:15, preferably smaller, if the better types of grass are to be encouraged.

There were also farms where the veld was very poor in spite of the ratio of cattle to sheep being much smaller than 1:15. The trouble in these cases, however, was purely a question of overgrazing. By this is meant that too many animals are kept for the edible plants on the farm and that no rotational grazing is practised.

It should be stressed that this ratio as has been explained, is not based on scientific research but on practical observations over a very large area. It is becoming increasingly clear, however, that this factor is of the utmost importance, and we therefore wish to bring it to the attention of farmers for more careful consideration.

Carrying Capacity.—Keeping too many animals for the edible plants without practising rotational grazing is bound to have disastrous consequences. During the above investigation it was found that

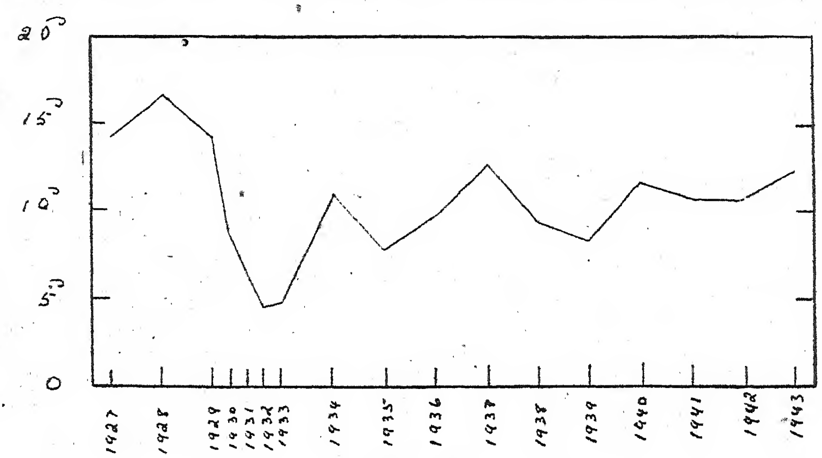


FIG. III.

Average prices per lb. wool in grease 1927-43.

the number of sheep units per morgen ranged from 1·1 to 2·7 per morgen. It is unnecessary to state that the poorest farms are those which are over-stocked, and the best farms those which are lightly stocked, namely, with 1·4 to 1·1 sheep units per morgen in the grassveld and mixed grassveld areas, respectively, and where rotational grazing is practised systematically.

Bearing in mind the "steekgras" problem, it seems inevitable that existing farming practices will have to be changed, but instead of suggesting a drastic change from wool to non-woolled sheep we would like, in addition to what has already been said about the veld, to submit the following points for consideration.

Hamel-farming.

In the area under discussion, it was found that some farmers still keep large numbers of hamels, but under the circumstances described above, this cannot be recommended. It would be much wiser to farm with ewes only and to sell the young hamels as soon as possible. Not only will this greatly relieve the veld, and accelerate its recovery, as well as help to prevent tramping out, but it will also be found that under favourable conditions the ewe and lamb are more remunerative than the hamel. Even if the annual wool production of a lambing ewe is from one pound to three pounds less than that of a hamel, which represents a loss of only a few shillings, she produces a lamb which at the age of 9 to 10 months is worth anything up to 15s. to-day. A hamel is usually kept for four years, and even if the ewe with her lamb shows a profit of only 5s. a year, this amounts to £1

over the four years. The meat market is very good to-day and there is no reason to believe that there will be any change in the near future.

It must be stated most emphatically, however, that farmers who wish to go in mainly for ewe farming, will make a success of the undertaking only if a high percentage of the ewes lamb and a large number of lambs are reared. At least 3 to 4 rams must be used for every 100 ewes, and the mating period should not be less than six weeks. The ewes must be in a good condition before mating, especially if they are to lamb before the winter. They must be free from internal parasites, and must be placed on reserved veld after lambing. Extra green feed in the form of green pasturage, lucerne, spineless cactus or salt-bush must be provided. The lambs should arrive before the winter, so that they are not born at a time when worm infestation is common.

Shearing time.—In order to cope with the "steekgras" problem farmers have found it necessary to shear every 6 months instead of every 12 months. We recommend that farmers should rather shear every eight months, provided a B-length of wool can be grown in that period. Shear, for example, in April—December—August—April. There is no difference in the quantity of clean wool between an 8 months' and a 12 months' growth, if conditions are equally favourable. In other words, two clips of 12 months' growth (clean basis) are equivalent to three clips of 8 months' growth. It should be emphasized, however, that a B-length wool means 2¼ inches after it has been shorn, so that it can be classed in a B-line, and not 2¼ inches while still on the sheep. We are, however, not strongly in favour of shearing at six-monthly intervals. Apart from several other considerations, the farmer must, in addition, drop 2 per cent. clean yield on his wool, if it is 2 inches or shorter when sold. This means of loss of nearly ½d. per lb. of wool per year or approximately £20 on a clip of 10,000 lb. of wool.

Crossings.—Where farmers wish to start crossing their merinos, we would advise the use of a pure-bred ram of one of the mutton breeds, which produces a good white commercial wool, or even a grade ram, rather than a Persian, Afrikaner or Cape ram. Such cross-bred wool realizes only about 1d. per lb. less than good merino wool, while cross-wool containing hair, kemp, and coloured fibres have a very low market value. Suitable mutton-breed rams which can be recommended, are Dorset Horn and the German merino.

Summary.

To return to the title of this article, we maintain that if the conditions described above are allowed to develop unchecked, merinos will gradually be replaced by non-woolled sheep. Profitable merino farming can be placed on a sound footing only if the requirements can be met for fertility, maintenance of the body, milk in the ewes, and in addition for the production of wool and mutton. We are forced to the conclusion, therefore, that merino farming in the southern Orange Free State has not yet been stabilized. If this stabilization can indeed be effected, and if no actual overgrazing is allowed, it will probably take place on a considerable smaller scale than is the case at present. It is also clear that the process must be accompanied by cattle farming, and to a much greater extent than is at present the case, especially in grassveld areas where "bitterbos" and "steekgras" have not yet become a problem.

Breeding Experiments with Ducks.

P. J. Serfontein, Professional Officer (Poultry Research) College of Agriculture, Potchefstroom.

SPLIT wings in fowls are considered to be a heritable character. The possibility therefore exists that crooked wings in ducks may be of a similar nature. In order to establish this possibility a breeding pen was made up consisting of one drake and six ducks, all of which had both wings crooked. This pen was compared with three other pens containing the same number of birds with normal wings. All the ducks in these groups were trapnested individually and received the same treatment. Furthermore, the same pens were used to determine whether certain matings or individual ducks are responsible for stunted ducklings or hunch-backed birds. In the third place pigmentation of the beaks and legs of these birds was described in order to ascertain whether there is any connection between the bleaching which takes place and the number of eggs laid.

Inheritance of Crooked Wings, Stunted and Hunch-backed Ducks.

As has already been mentioned, all the ducks and drakes in pen A had typically crooked wings on both sides, while all the ducks and drakes in pens B, C and D were quite normal in this respect. Ducklings of these four groups were used in different feeding experiments, but the progeny of all four groups were always fed the same rations, so that the feed factor was always the same for the four groups. At the age of ten weeks all the ducklings were carefully examined for any abnormality in the wings; stunted ducklings and hunch-backed birds which developed during the ten weeks, were also recorded.

DEVELOPMENT AND ABNORMALITIES.

Pens.	Number of Duck-lings.	Crooked Wings.			Stunted Ducklings			Hunch-backed Ducklings.		
		Drakes.	Ducks.	Per cent.	Drakes.	Ducks.	Per cent.	Drakes.	Ducks.	Per cent.
A.....	52	3	6	17·30	1	—	1·92	—	—	—
B.....	41	2	4	14·63	—	1	2·43	—	—	—
C.....	62	3	1	6·25	—	—	—	—	—	—
D.....	32	3	1	12·5	—	—	—	—	—	—

It is doubtful whether the fiures given above are of any value. In the first place, the numbers are too small and, in the second, the writer had a similar experience with perosis. A pen of Rhode Island Reds consisting of hens and a cock which has developed this abnormality was made up and compared with a pen of normal birds in exactly the same way as in the duck experiment. The perosis pen had the largest number of perosis chicks, and after the results had been statistically treated, there was a significant difference. Ten years later, however, it was proved that perosis is caused by a choline and manganese deficiency. From the results obtained in the duck experiment the occurrence of abnormal wings was fairly uniformly distributed, and there were no individual cases which showed a predominant tendency to propagate any one of the three deformities.

Pigmentation and Bleaching.

At the commencement of the laying season, i.e., at the beginning of August, the beaks and legs of 24 ducks and four drakes were

described. In addition, two sets of colour charts were made in order to serve as a standard, and were graded according to intensity of colour. No. 1 was the deepest colour, and corresponded exactly to the colour of the beaks and legs of the drakes which should remain constant under normal treatment. The lowest number was assigned where practically no pigment was present.

Unfortunately, the observations could not be made without interference since the ducks were disturbed on two different occasions by strange dogs. On each occasion the ducks stopped laying temporarily, and individual birds even went into a moult. Ducks are very sensitive and, consequently, are very easily put off production.

Owing to the disturbances and individual differences among ducks, it is impossible to give the results in the form of figures as was the intention when the experiment was planned. For this reason it was decided to give only a general description of the findings.

In August the beaks of the four drakes were a deep orange with no sign of any foreign colouring, and the feet and legs were an orange-red. This colour was used as the standard on the charts. For seven months the colour descriptions were made twice a month, during which period there were no deviations from the original colour in the legs and beaks of the drakes. The only change observed in the beaks was a thickening of the horny part near the nostrils. This thickening occurred in layers which flaked off around the edges, and could be pulled off after a time, without injuring the bird. These scales, as well as the part of the beak which they covered, retained the original colour like the rest of the beak. In other words, no bleaching occurred in the beaks and legs of Pekin drakes.

The beaks of all twenty-four ducks used were a deep orange, and their legs were orange-red in colour but cases occurred where very small black spots were observed on the beaks and legs. In no case, however, were there more than two spots observed on the beak of the same duck. In some cases, however, there were up to four spots on the legs; it was the exception for cases to occur without any leg spots at all. Some ducks also had black streaks on the tip (bean) of the beak. As in the cases of the drakes, two descriptions were also taken every month for seven months. The average production for the 24 ducks was 68·17 eggs for the production season of six months. The lowest individual production was 44, and the highest 104 eggs.

No definite correlation exists between the number of eggs and the extent of bleaching. Some ducks with a high production, as compared with those with a low production, showed more pigment in the beak at a given moment. These exceptional cases may possibly be due to the fact that certain ducks consume greenfeed more readily than others. In spite of individual differences in the bleaching among ducks, it may definitely be accepted that in all Pekins bleaching in the beak occurs as the production and period of production advances. This bleaching, however, does not take place systematically as in fowls. The bleaching of all the pigmented parts of the beak takes place slowly and simultaneously during the period of production. The lower part of the beak does not contain so much pigment, so that it always appears lighter in colour as bleaching of the whole beak takes place. Ducks with a production of 70 eggs or more had practically no pigment in the beak in January. There were, however, ducks with a production of only 40 eggs which had a similar appearance.

As the orange pigment disappears, however, small black spots and brown marks appear. It would appear as if these marks are normal, and only becomes visible when the orange pigment disappears. These spots are concentrated mostly in the immediate neighbourhood of the nostrils and gradually spread from this region to the rest of the beak. In January the beaks of some of the ducks appeared almost black, when seen from a distance. Here too there was no correlation between production and the concentration of spots. So, for example, the duck with the highest production showed practically no black spots, her beak being covered only with brown spots. On the other hand, the beaks of those ducks with a production of 50 eggs or less were covered with conspicuous black spots.

Bleaching of the legs in the ducks also occurs, but this is not as pronounced as in the beaks. Here also there was an increase in the number of black spots as the production season advances.

From these observations it is clear that any black spots on the beaks of Pekin drakes may serve as a disqualification, as stated in the official standard, but this is not applicable to ducks. This standard applies to judging at shows and the selection of breeding pens. Since most shows are held in autumn or winter, when ducks are no longer in production, this standard requirement hardly ever gives any trouble. In selecting breeding pens, however, it would be a great drawback if ducks were disqualified because they showed black spots on the beaks during the laying season which usually extends from July to the end of February.

Ducks show a bleaching of the pigmentation in the beaks and legs during the laying season. This bleaching is, however, very irregular, and as the pigment disappears, black spots or brown marks appear separately or simultaneously. As the orange pigment reappears, these spots disappear.

Production and Hatchability in Pekin Ducks.

The same trouble was experienced with hatchability as during the 1941 hatching season. It is found that hatchability is reasonably good during September, but that it gradually declines and is very poor at the end of November.

The following two rations, together with greenfeed, were fed to breeding ducks:—

Ingredients.	Rations.	
	1.	2.
Yellow mealie meal	55½	54
Ground oats	12	12
Wheaten bran	8	8
Lucerne meal	8	8
Fish meal (concentra)	6	3
Meat- and Bonemeal	5	2½
Groundnut oil cake	2	2
Oystershell powder	1½	2½
Bonemeal	2	3
Brewers' yeast	—	5
	100	100
Fibre	4·88	4·92
Crude Protein	16·05	16·11
Calcium	2·05	2·23
Phosphorus	0·98	0·89

Ration No. 1 was fed to all breeding ducks except those of group 1 which was subdivided into four groups and fed on ration 2. This group consisted of six Pekin ducks and one Pekin drake, and had access to a small pond. In addition, these six ducks were trapnested. Brewers' yeast was included in this ration in order to see whether the flavin would improve the hatchability. Groups 2 and 3 each consisted of 18 Pekin ducks with drakes in the same proportion as in group 1. Group 2, however, was placed in a run without any water, and group 3 was placed next to a permanent stream. Groups 4 and 5 consisted of six Aylesbury ducks and 24 Khaki-Campbell ducks together with drakes in the ratio of one to six as in group 1. These groups were also kept in runs without water. The last four groups were not trapnested.

The average production from August to the end of January was as follows:—

PRODUCTION.

	Group 1. Pekins.	Group 2. Pekins.	Group 3. Pekins.	Group 4. Aylesbury.	Group 5. Khaki-Campbells.
	Ration 2. Swimming pond.	Ration 1. No swimming water.	Ration 1. Permanent stream.	Ration 1. No swimming water.	Ration 1. No swimming water.
August	·2	2·3	—	3·2	1·9
September	15·3	19·7	13·1	18·8	16·1
October	19·6	24·4	12·5	19·2	18·4
November	17·2	20·4	11·6	20·5	16·9
December	10·3	15·6	6·2	14·2	12·1
January	3·1	15·6	5·5	14·2	12·6
AVERAGE TOTAL.	71·9	100·9	49·1	90·5	78·1

The average hatchability for the season was:—

	Group 1. Pekins.	Group 2. Pekins.	Group 3. Pekins.	Group 4. Aylesbury.	Group5. Khaki-Campbells.
	Ration 2. Swimming pond.	Ration 1. No swimming water.	Ration 1. Permanent stream.	Ration 1. No. S.W.	Ration 1. No swimming water.
Number of eggs placed in incubator	787	820	418	269	366
Percentage fertile	81·32	95·10	81·81	35·31	71·31
Percentage fertile eggs hatched	46·56	50·53	48·25	17·89	39·47
Percentage hatchability of total number of eggs placed in incubator	37·77	46·96	39·48	6·31	28·14

The hatchability as indicated in the above table is still unsatisfactory. Even group 1, which received flavin in the ration gave no better results than group 2 or 3. It is noteworthy that group 2 gave the best results. This group had no access to swimming water in any form, and here the fertility and hatchability were best.

[Continued on page 856.

Pasture Management.

J. E. Pons, Extension Officer, Ixopo, Natal.

IT is perhaps not generally realized what an important rôle roots of pasture crops and grasses play in the well-being of the pasture. Because we cannot see the roots, we easily forget their significance. If we do think of them at all, we usually consider that they are functioning well and that they do not need any attention or care.

Recent research has proved that the growth, health and vitality of the parts above the ground, are directly dependant on the growth and well-being of the roots.

Proper Balance between Roots and Tops.

When a pasture is left ungrazed, both the tops and the roots are allowed to develop normally, and a proper balance is set up between the two. As soon as a pasture is grazed, however, this balance is upset. More leaves have to be produced to replace those lost by grazing and in this process there is a partial withdrawal of food reserves from the roots to the leaves. In order to explain what takes place then, it is perhaps necessary to describe the function of the roots and tops (leaves) of plants.

The roots take from the soil different mineral salts dissolved in water. This solution of chemicals is then conducted to the leaves and through certain processes that take place in the leaves in the presence of sunlight, these salts, together with certain gases inhaled from the air, are changed into readily assimilable plant foods. These manufactured plant foods are then conducted to the different parts of the plant where they are utilized in plant growth. In the case of grasses and other perennial plants, a reserve of plant foods is stored in the crown and the roots. This usually takes place in autumn.

The substances absorbed from the soil are, therefore, in the raw state and cannot be utilized by the roots until they have been processed by the leaves. Thus in any competition between the roots and leaves, the former will be the chief sufferers. If leaves are continually being removed, as in the case of heavy grazing, more and more of the final product is necessary to produce new leaves. The leaves utilize whatever plants foods are available, until in the long run the roots are starved, and diminish in size.

The weaker the roots become, the less raw plant foods are passed to the leaves, and the weaker the whole plant becomes. A vicious circle is set up, where both the roots and the leaves become weaker and weaker. If heavy grazing is continued too long, the rate of growth of the pasture will slow down until, finally, the desirable grasses die from starvation or are smothered out by more vigorous grasses or weeds.

Experiments conducted in New Zealand have proved that where Rye grass, grown under ideal conditions, is cut weekly, the weight of the roots was only half (in round figures) the weight of the roots of similar plants cut at fortnightly intervals and only one-third of the weight of plants cut every three weeks. Although these may be extreme figures, the same trend will be found in ordinary pastures.

It will be readily be understood why overgrazing of established pastures is so dangerous.

Critical Periods.

It is also important to know that grasses are more detrimentally affected by overgrazing during certain periods of the year than during others. The most critical periods are spring and autumn.

In autumn a grass plant endeavours to store a reserve of plant-food in its roots and crown in order to carry it through the winter and to start a vigorous growth again in spring.

Experiments conducted at Cedara in connection with inoculation of clovers have revealed, for instance, that half of the plant foods and especially nitrogen and phosphoric oxide, assimilated by the clover plant, were retained in the roots. In these experiments it was also found that the roots of the clover plant weighed twice as much as the leaves—a further proof of the importance of the root system in pasture plants.

When a pasture is heavily grazed or frequently mown during autumn, it is prevented from building up this reserve of plant foods in its roots. If, in addition, a pasture is also heavily grazed in winter, the position is further aggravated.

The detrimental effect of autumn grazing was well illustrated in certain veld-hay making and grazing experiments conducted at the Estcourt Research station. Two paddocks of the same size were mown twice during the summer. Paddock A was grazed in the autumn, while paddock B was grazed only after the frost when the grass was dormant. Paddock A produced 170 bales of hay the first season, and 200 bales the next year, which was a very good season. Paddock B produced 200 bales the first season and 317 the next. Thus, due to autumn grazing the increase was only 30 bales as compared with 117 in the camp which had been rested in the autumn.

If on the other hand a pasture is hard grazed in the early spring, the plant continually draws upon the food reserve in the roots and is prevented from manufacturing a new supply of plant foods for further growth. In consequence the vicious circle of weaker roots and less tops is started early in the season.

Another important factor in spring is the soil temperature. At the end of winter plant growth starts as soon as the soil has attained a certain temperature. Micro-organisms in the soil which decompose organic nitrogen and make it available for the plants, only start functioning at a higher temperature than is necessary for the growth of plants. In many years there will be a lapse of time between the time when plantgrowth starts and the time when plantfoods will be available. Therefore, although there may be an increase in leaf growth in early spring, there is usually a decrease in food reserves in the roots and crown. Drought in early spring may further complicate matters.

Young Pasture.

Newly established pastures are more sensitive to overgrazing than older pastures and consequently require more careful management. They should be allowed to develop both roots and leaves in the early stages of growth. The most critical period is the first spring after an autumn sowing. If overgrazed at this stage, the young roots are prevented from penetrating the deeper layers of soil and the plants may suffer from drought in the subsequent summer months.

It is not, however, contended that young pastures should not be grazed at all, but they should be grazed in such a manner that a certain amount of foliage is left when the animals are taken out again. The grass should be allowed to reach a height of about 4 to 5 inches before being grazed again. In this connection heavy grazing with a large number of cattle for short periods at a time, is better than continual light grazing with a few animals.

Grazing should, however, be discontinued before autumn, to allow the young plants to build up a good food reserve. In this way a good foundation is laid for a successful pasture.

Mixed Pastures.

Where the pasture is mixed the situation is complicated, because certain grasses will appear earlier in spring and grow quicker than others. The quicker growers are usually more palatable. If such mixed pastures are heavily grazed in spring the earlier grasses, e.g., rye grasses, cocksfoot, etc., will be grazed each time to the ground, while the slower growers such as fescues, natural grasses and clovers, will be left practically untouched. Later in the season when the slower grasses have grown out, there is usually such an abundance of growth, that the grazing will then not have such a marked effect. It will be readily understood that, if a mixed pasture is grazed heavily each spring, the slower grower will ultimately predominate.

Heavy grazing of winter pastures in winter will aggravate the position. A common mistake, generally made, is to overgraze in spring, autumn and winter and to under-graze in summer.

Where wild white clover is included in the mixture, the establishment and vigirous growth of the best grasses in the mixture must be encouraged by moderate grazing in summer and resting during spring and autumn. The clover on the other hand can be encouraged by controlling the too vigorous growth of grass in midsummer.

If the clover appears to get the upper hand, the pasture should be allowed to grow out so that by shading and partially lifting the runners of the clover from the ground, the clover will be prevented from spreading further.

Conclusions.

Careful management of pastures is necessary to maintain a vigorous root system and the proper balance between roots and leaves.

Where possible, pastures should be lightly grazed or rested during autumn and spring. Where, however, a farmer has been forced, due to certain circumstances, to graze a pasture heavily in autumn, he should rest it in spring, and *vice versa*. Paddocks intended for early spring grazing should, in addition, receive an extra topdressing of readily available nitrogen fertilizer to counteract the shortage of nitrogen at this time of the year.

As pastures are generally undergrazed in midsummer, better use of the grass should be made at this period of the year, either by grazing or mowing for hay or silage. The utilization of the grass for hay or silage also increases the total productivity of the pasture.

Rather overgraze an older pasture than a newly established pasture. Similarly, rather overgraze an annual pasture than a perennial pasture. Do not allow sheep too long in a young pasture for, due to their short grazing habits, they soon eat the heart out of any pasture.

Mixed pastures need careful management to maintain a proper balance between the different grasses and clovers.

Close grazing for short periods at a time, with a rest in between each grazing period, is better than continued lenient grazing.

A system of paddocks with rotational grazing is actually very necessary. Where such paddocks cannot be made owing to lack of funds or material, it is suggested that portions of a big paddock be mown and topdressed in rotation. The animals will then be inclined to concentrate on the younger and more nutritious grass.

If a pasture tends to be a failure the farmer generally blames the seed, the soil, the climate or something else, but very rarely blames himself for having mismanaged it some time or other.

Breeding Experiments with Ducks:—

[Continued from page 852.

Although these results show that the provision of swimming water does not improve fertility, it is always preferable when available because ducks look very unattractive if they are not provided with swimming water.

Summary.

1. Hatchability in ducks is a factor which justifies thorough investigation. At the beginning of the season, i.e., in September and October, it is reasonably good, but gradually declines. At the end of December the hatchability is so poor that the results do not justify the costs involved in putting eggs into the incubator.

2. The addition of flavin effected no improvement in this comparative experiment.

3. The provision of swimming water for breeding ducks appears to have no advantage in so far as fertility and hatchability are concerned, as compared with ducks kept in runs without any water.

A New Sweet Sorghum Variety:—

[Continued from page 842.

cultivation and handling of sorghums have already been given (see *Farming in South Africa*, October, 1942).

Owing to the fact that sorghums are gross phosphate feeders, drawing their requirements mainly from the upper layers of the soil, experience has shown that maize never does well without phosphate after kaffir corn or sweet sorghum. This unfavourable effect disappears upon the application of phosphatic fertilizer. In fact, the effect of sorghums in a system of crop rotation where phosphate is applied is beneficial except in soils requiring nitrogenous fertilizer. This must be ascribed primarily to the large number of roots which remain in the soil and which decompose slowly on account of their high sugar content. In the case of soils which are deficient in nitrogen, this condition gives rise to a very definite "negative period" in the following crop. Since dryland soils in the western Transvaal contain an adequate supply of nitrogen during the period of summer growth, it is noteworthy that sorghums have a beneficial effect on the cultivability of the soil and to a certain extent exercise a binding effect on the more sandy soils when they receive sufficient phosphatic fertilizer and grow luxuriantly. An experiment which is in progress at this institution will in due course be able to provide more critical data on this point.

It is doubtful whether the Haakdoorn variety is equally well suited to the eastern grain-producing areas where the season demands a faster-growing type. In the western grain-producing areas of the Transvaal and the Orange Free State, as well as in the northern Transvaal, it may prove to be better adapted. This institution does not have at its disposal the facilities for producing large quantities of seed and will therefore not be able to supply farmers with seed. We hope, however, to be able at the end of this season to supply farmers with small quantities of seed for testing out. Farmers outside the western Transvaal grain-producing area are therefore advised to try this crop on a small scale before venturing upon large-scale production.

Plum Packing Experiments during the 1942-43 Season.

T. Micklem, D. du Preez, and Dr. M. W. Black, Pomologists, Western Province Fruit Research Institute, Stellenbosch.

A MISCELLANEOUS assortment of packs and packages have been used for marketing plums in South Africa. Even when the pre-war export plum packs are considered, it will be found that a wide range of packing methods were employed. Plum varieties, probably more than any other type of soft fruit, vary in size, softness of flesh and texture of skin. This variation has doubtless been one of the causes for the inconsistency of plum-packing regulations in the past.

Since the outbreak of war, the plum industry has been faced with ever growing problems. Not only has the average grade of the fruit fallen, due to insufficient pruning and thinning, but supplies of packing material have been short, and the problem of disposing of a large portion of the crop as dessert fruit has become acute. Judging from last season's market reports, combined with observations while visiting some of the chief Union markets, it would appear that the multiplicity of counts, weights and packs in current use, were detrimental. Plums were marketed in single, double and triple layer containers, and the lack of standardisation in counts, etc., sometimes resulted in the buyer being misled as to the actual quality of the fruit he was buying.

The experiments carried out last season aimed at establishing a standard range of packs and containers, suitable for marketing plums in the Union. Where possible, the cheapness of the packing method was considered. After one season's work it is realised that much has still to be accomplished before a complete standard economic range of packs can be recommended. However, as some of the broader principles tested in connection with plum packing have given interesting results, it is hoped that this progress report may be of some assistance to plum packers.

Experimental Methods.

Only the important Santa Rosa, Gaviota and Kelsey plum varieties were used in these trials, and more delicate varieties such as Methley, Beauty, Apple Plum and Wickson were not incorporated. The fruit was packed in standard single, double and triple layer trays (18 in. by 12 in.), as well as in multiple layers in Californian pear bushels. In these different containers, wrapped and unwrapped packs were used. Two basic methods of arrangement were employed, viz.:

(1) The South African method, plums placed on their sides in the layer.

(2) The Californian method, plums placed on their ends in the layer.

In the various containers the performance of different liner and padding materials were tested. These included white corrugated paper, plain white paper, Greenkraft, woodwool, sisal, poplar sawdust, sawdust and shavings of *Pinus insignis* and *Pinus pinaster*, oat straw and rolled oat chaff. With multiple layer packs, the use of cover sheets between layers was tested, while a full range of packs in unlined boxes was also included. This polyglot of packing methods included most of those in common use, as well as a large number of new systems.

The fruit used in these trials came from the Elgin and Groot Drakenstein areas. A detailed summary of the variety, place of origin, storage treatment and place of examination is now presented in Table I.

TABLE I.—*Packing and Storage Treatment.*

Variety.	Place of origin.	Storage treatment.	Place of examination.
Santa Rosa.	Bien Donné, Groot Drakenstein.	18 days in cold store, per cold truck, first examination 3 days later..............	Johannesburg.
	,,	18 days in cold store, first examination1 day later..................................	Stellenbosch.
	Eikenhof, Elgin.	7 days in cold store, per cold truck, first examination 3 days later................	Johannesburg.
	,,	7 days in cold store, first examination 1 day later.................................	Stellenbosch.
Gaviota.....	Bien Donné, Groot Drakenstein.	6 days in cold store, per cold truck, first examination 5 days later................	Johannesburg.
	,,	6 days in cold store, first examination 4 days later................................	Stellenbosch.
	,,	10 days at room temperature.............	Stellennosch.
Kelsey......	Meerlust, Groot Drakenstein.	Direct per hot truck.....................	Johannesburg.
	,,	16 days in cold store, per cold truck, first examination 6 days later................	Johannesburg.
	,,	37 days in cold store, per cold truck, first examination 3 days later................	Johannesburg.
	,,	11 days at room temperature.............	Stellenbosch.
	,,	16 days in cold store, first examination 3 days later................................	Stellenbosch.
	,,	37 days in cold store, first examination 2 days later................................	Stellenbosch.
	Eikenhof, Elgin.	Direct per hot truck.....................	Johannesburg.
	,,	16 days in cold store, per cold truck, first examination 3 days later.................	Johannesburg.
	,,	28 days in cold store, per cold truck, first examination 3 days later................	Johannesburg.
	,,	35 days in cold store, per cold truck, first examination 3 days later................	Johannesburg.
	,,	10 days at room temperature.............	Stellenbosch.
	,,	28 days in cold store, first examination 1 day later................................	Stellenbosch.
	,,	35 days in cold store, first examination 1 day later................................	Stellenbosch.

Fruit cold stored at Table Bay Docks, Cape Town.

On inspection records were taken on appearance of pack, tightness, percentage bruising and rotting, stage of ripeness and general keeping quality. In conjunction with the investigations on packing methods, data was also collected from local packers, and from market buyers, and their findings were compared with experimental results. Some records on the shrinkage on storage of the varieties tested were taken.

Experimental Results.

The problem of evolving a standard range of plum packs, was found to be complex and difficult; more so than in the case of apples, pears and peaches. The results obtained during the 1942-43 season have not solved this problem and there is need for further investiga-

tion. As in the case of the reports on pear and peach packing, a detailed summary of the results obtained are beyond the scope of this publication. The more important results will now be given.

(1) *Use of Wrappers.*—The use of wrappers resulted in firm, attractive packs. When the fruit was not wrapped, it was impossible to keep the pack completely tight and such packs were not as attractive. The importance of the good impression made by an attractive pack cannot be overlooked. However, under present con-

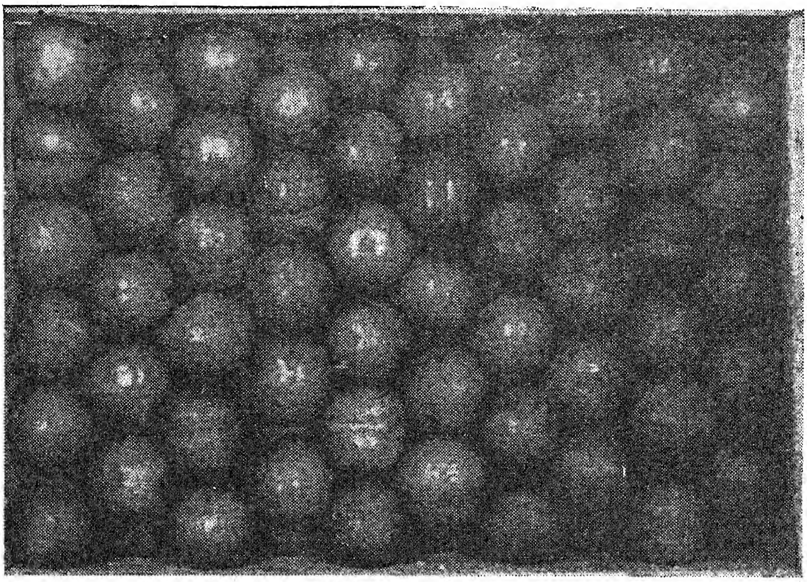


Fig. 1.—Triple layer Gaviota plum pack in unlined tray. Plums packed on sides.

ditions, it is thought that the use of wrappers can be safely discarded, as wrapping did not improve fruit quality to any marked degree.

(2) *Cover Sheets.*—With multiple layer packs, cover sheets should be placed between each layer. It is important that these sheets should not be too small.

(3) *Packing Style.*—The Californian pack was more attractive for unwrapped fruit than the method commonly used in the Union. This new pack did not cause bruising with the varieties tested, and on the whole tended to give firmer packs. Further work should, however be done before preference is given to this method.

(4) *Containers.*—Results showed that plums up to 2 in. in diameter carried well in single, double and triple layer trays. Plums of larger grades were only packed in single layer trays, but it is probable that the larger grades could also be packed in multiple layers. When six layers of plums were packed in the Californian pear bushel, the fruit kept surprisingly well. This pack is, however, too heavy and sagged badly. The possibility of four-layer packs should be considered in future work.

The important saving in boxwood brought about by using multiple layer packs, especially in smaller grades, must be stressed. For example, it was found that plums graded to $\frac{5}{8}$ in. diameter could be packed in single, double and triple layer packs, in $1\frac{3}{4}$ in., 3 in.

and 4 in. trays respectively. In this case 6,000 single layer trays, 3,000 double layer and 2,000 triple layer trays would hold the same amount of fruit. On last year's Deciduous Fruit Board's price for boxwood, this would result in a £35 saving in the cost of boxwood, when using the triple instead of the double layer pack, apart from the saving in material as such. Further savings should also accrue from lower distribution and packing costs. Naturally the price obtained in relation to the number of layers packed, would play an important part. The opinion is expressed that a definite grade difference should exist between the different plum packs, as the present practice of selling the same grade both in double and triple layer packs is misleading.

(5) *Liners and Padding Material.*—(*a*) Woodwool proved an excellent liner for plum packs, and kept the fruit in position. This material has the disadvantage of taking up too much space in the box, and for this reason the trade was not in favour of packs in which it was used. The opinion was also expressed that the use of woodwool leads to more rapid ripening of plums.

(*b*) Sisal proved a good substitute for woodwool, provided the fruit was not cold stored. When it was the sisal compacted, causing a slackening of the pack, which resulted in jumbling and bruising. Sisal, due to its dingy colour, was not as attractive as woodwool.

(*c*) White corrugated paper liners proved effective, kept the fruit well in position, and such packs could be displayed with effect.

(*d*) White paper and Greenkraft liners to a large extent protected the plums against bruising, but on storage such packs invariably became slack. Resultant sagging and jumbled packs were not a good advertisement for quality fruits.

(*e*) Sawdusts and shavings of Poplar and Pine controlled bruising, and kept the fruit in position, but the trade was not in favour of these packs, due to the dirty appearance of the fruit, and the difficulty of ascertaining the size and general quality of the contents.

(*f*) Oat chaff and straw caused some rotting and were not particularly attractive.

(*g*) Packs in unlined trays became very slack, and bruising and chafing occurred when the fruit was not wrapped. In the case of wrapped fruit, the indications were that packs in unlined trays were a success.

(6) *Tightness of Pack.*—With multiple layer packs, it was found that the container must be tightly filled, and the fruit in the top layer packed with a slight bulge. If this is not done, the pack sags so

TABLE II.—*Grading with a Mechanical Grader.*

Bin.	Mechanical Grader setting.	PERCENTAGE. Actual diameter of plums, as per grade plank.					
		$1\frac{1}{2}''$.	$1^9/_{16}''$.	$1^{11}/_{16}''$.	$1^{13}/_{16}''$.	$1^{15}/_{16}''$.	$2^1/_{16}''$.
1	$1^9/_{16}''$	76	24	—	—	—	—
2	$1^{11}/_{16}''$	6	61	29	4	—	—
3	$1^{13}/_{16}''$	—	12	63	24	—	—
4	$1^{15}/_{16}''$	—	—	14	60	26	—
5	$2^1/_{16}''$	—	—	—	22	63	15

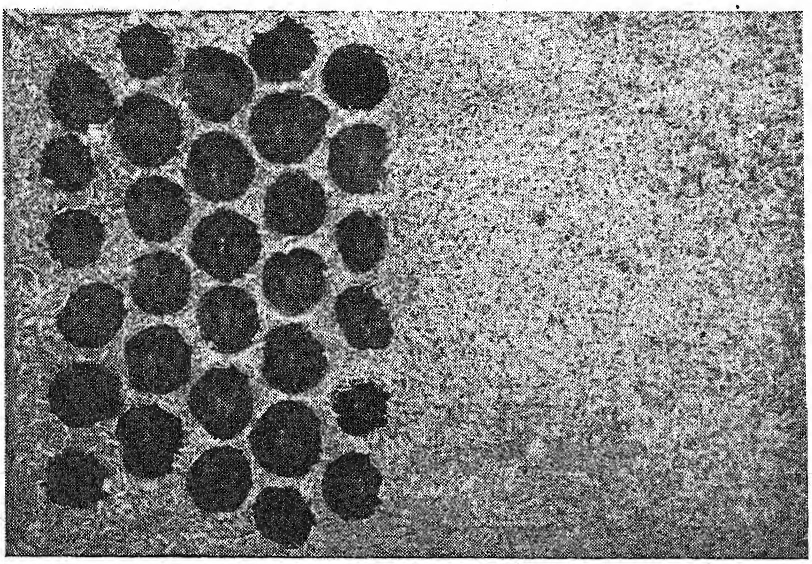


FIG. 2.—Triple layer Santa Rosa plum pack, in Poplar sawdust.

much that jumbling results. Often the shrinkage is so great that plums from one layer, slip into spaces formed in the lower one. A small bulge test was undertaken with triple layer Kelsey plum packs, which were lidded. At this stage the average top bulge was 1·04 in. and bottom 0·64 in. After one week in cold store, the bulges were again measured, and averaged 0·64 in. top and 0·57 in. bottom.

(7) *Grading*.—When plums are grown on a large scale, they are generally graded over a mechanical grader. These machines do not grade accurately, and in Table II the results of a performance test

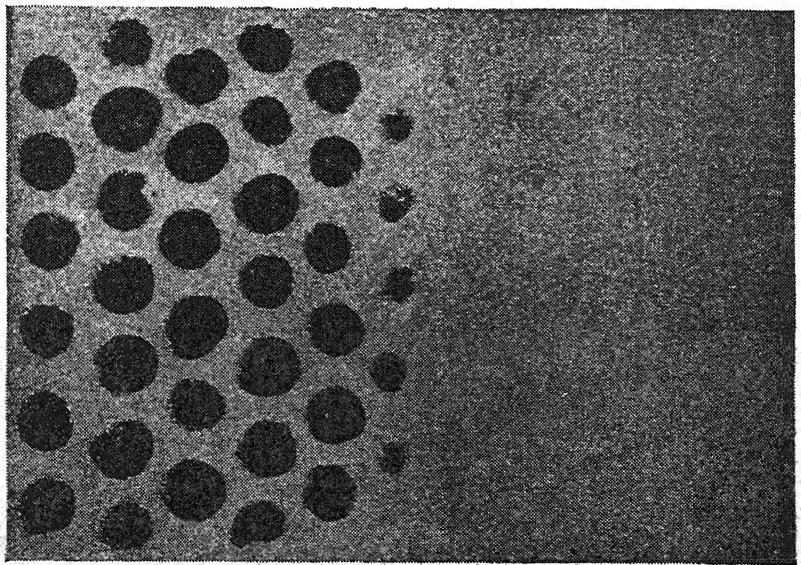


FIG. 3.—Triple layer Santa Rosa plum pack, in Pine sawdust.

TABLE IV.—*Sundry Data on Plum Packs, Boxes Lined with Corrugated Liners, with Sheets of Plain White Paper between Layers.*

Grade. diameter.	SINGLE LAYER WRAPPED.					SINGLE LAYER UNWRAPPED.					DOUBLE LAYER WRAPPED.					DOUBLE LAYER UNWRAPPED.					TRIPLE LAYER WRAPPED.					TRIPLE LAYER UNWRAPPED.				
	1.*	2.	3.	4.	5.	1.*	2.	3.	4.	5.	1.*	2.	3.	4.	5.	1.*	2.	3.	4.	5.	1.*	2.	3.	4.	5.	1.*	2.	3.	4.	5.
1¼″	7×6×12	78	75	1¼″	—	8×8×14	12	110	1½″	—	8×7×13	195	190	2¾″	—	8×8×14	224	220	2½″	—	8×7×13	293	290	4¼″	—	8×8×14	336	330	4″	—
”	—	—	—	—	—	8×8×13	104	100	1½″	—	—	—	—	—	—	8×8×13	208	—	—	—	—	—	—	—	—	8×8×13	312	—	—	—
”	—	—	—	—	—	8×7×13	98	100	1½″	—	—	—	—	—	—	8×7×13	195	—	—	—	—	—	—	—	—	8×7×13	293	—	—	—
1⅜″	6×6×12	72	70	1¾″	—	8×7×13	98	90	1½″	—	7×7×12	168	160	2¾″	—	8×7×13	195	190	2¾″	—	7×7×12	252	250	4¼″	—	8×7×13	293	290	4″	—
”	—	—	—	—	—	7×7×13	91	90	1½″	—	—	—	—	—	—	7×7×13	182	—	—	—	—	—	—	—	—	7×7×13	273	—	—	—
1½″	6×6×11	66	65	1¾″	5	7×7×12	84	80	1¾″	6½	6×6×11	132	130	2¾″	10	7×7×12	168	160	2¾″	13	6×6×11	198	195	4¼″	15½	7×7×12	252	250	4″	19½
”	—	—	—	—	—	7×6×12	78	80	1¾″	—	—	—	—	—	—	7×6×12	156	—	—	—	—	—	—	—	—	7×6×12	234	—	—	—
1⅝″	6×6×10	60	60	2″	5½	7×6×11	72	70	1¾″	7	6×6×10	120	120	3″	11½	7×6×11	143	140	2¾″	14	6×6×10	180	180	4½″	17½	7×6×11	215	215	4¼″	21
1¾″	6×5×10	55	55	2″	6½	6×6×11	66	65	2″	8	6×5×10	110	110	3″	13	6×6×11	132	130	3″	16	6×5×10	165	165	4¾″	20	6×6×11	198	195	4½″	24
1⅞″	5×5×10	50	50	2¼″	7	6×6×10	60	60	2″	8½	5×5×10	100	100	3¼″	14½	6×6×10	120	120	3″	17	5×5×10	150	150	5″	21½	6×6×10	180	180	4¾″	26
2″	5×5× 9	45	45	2¼″	7½	6×5×10	55	55	2¼″	9	5×5× 9	90	90	3½″	15	6×5×10	110	110	3¼″	18½	5×5× 9	135	135	5½″	23	6×5×10	165	165	5″	28
2⅛″	5×4× 9	41	40	2½″	—	5×5×10	50	50	2¼″	—	5×4× 9	81	80	3¾″	—	5×5×10	100	100	3½″	—	5×4× 9	121	120	6″	—	5×5×10	150	150	5″	—
2¼″	5×4× 8	36	35	2½″	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2⅜″	4×4× 8	32	30	2¾″	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2½″	4×4× 7	28	25	2¾″	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2⅝″	4×3× 7	25	25	3″	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2¾″	4×4× 6	24	20	3″	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2⅞″	4×3× 6	21	20	3¼″	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3″	3×3× 6	18	15	3¼″	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3¼″	3×3× 5	15	15	3½″	—	—		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* 1. Pack. 2. Count. 3. Mark. 4. Approximate box size. 5. Nett weight of fruit (lbs.).

lined with corrugated paper or white paper. When the plums were packed in unlined boxes only 5 per cent. and 3 per cent. of the fruit developed skin crack in these two packs. A possible explanation of the virtual control of cracking in the unlined tray, is that due to better aeration, no deleterious accumulation of gasses due to a high rate of respiration, brought about by keeping containers at a high temperature after cold storage, took place. Furthermore, the water which accumulates on the surface of the fruit, due to condensation after storage, evaporated more rapidly with this open pack. No skin cracking took place when similar samples were sent to Johannesburg per cold truck. Here the rate of respiration would have been lower, while condensation was probably less. Santa Rosas from Groot Drakenstein which were cold stored for two weeks, and then ripened for one week at room temperature at Stellenbosch, developed less skin crack. In double-layer packs, in lined boxes with white corrugated paper or Greenkraft, 10 per cent. of the plums developed skin crack, while similar packs in unlined boxes developed no skin crack. While these results are only indicative, it is nevertheless felt that more research on this problem is merited. The possibility of developing packs that give better aeration should be considered. It might be mentioned that the popular Californian double and triple layer punnet pack (2), permits adequate aeration.

(11) *Standardised Packs and Counts.*—An attempt at supplying a range of packs and counts been made in Table IV. These were arrived at by comparing available data (1, 3) with results obtained experimentally and from commercial packsheds. Unfortunately, it was impossible to test out all these packs experimentally and, therefore whilst this data might serve as a guide, it cannot at this stage be regarded as standard.

In Table IV it will be seen that more than one count has been given in lower grades for unwrapped packs. The reason for this is that with round-shaped fruit like those of the Methley variety, more fruit of a certain grade size are packed per box, than would be the case with other oval-shaped varieties. In the wrapped pack columns, only the standard export packs (3) are shown. A separate count and mark has also been included for each pack. By marking the different packs in multiples of five, it is thought that the buyers would recognise the different grades more easily.

The nett weights given opposite some packs were calculated from weights of accurately hand graded Santa Rosa plums. It must, however, be stressed that when a mechanical grader is used, the average nett weights packed will generally be less. In the case of double layer packs, they may weigh from 1 to 3 lb., and for triple layer packs, from 1 to 4 lb. less. Slight differences occur in the nett weights of the same pack for different plum varieties. In multiple layer packs, this difference is seldom more than 1 lb. per box (1). It is found in practice, where mechanical graders are used, that the range of counts packed for different varieties, opposite any one grader setting, vary slightly. This is caused by the characteristic shape of the variety, affecting the performance of the mechanical grader.

The box sizes given opposite the different packs indicate the approximate depth required, to ensure a tight pack. When corrugated paper pads are placed between the layers, or when woodwool or sisal are used as padding, deeper boxes are required. It is important that growers should check up on sizes of boxwood when

they take delivery, as our experience last season was that most of the boxwood used in this work was 1/16 in. to ⅛ in. short of the requisite size.

Acknowledgments.

The costs of fruit and boxwood were mainly covered by a grant from the Deciduous Fruit Board. The authors would like to thank N. H. van der Meulen, Esq., of the Division of Economics and Markets, who co-operated with Dr. M. W. Black in examining experimental packs on arrival at Johannesburg. Thanks are also due to H. W. Blackburn, Esq., and Messrs. Pickstone & Son, Ltd., for supplying fruit, and for allowing experimental shipments to be packed in their packsheds.

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Land Service:—

[Continued from page 840.

service-minded, if tackled in the proper way, is one in which the educators of the youth can play no mean part. The Department willingly offers the supervision, guidance and advice of its most competent officers for this purpose.

The agricultural club movement for the youth has in many respects laid the foundation for this movement among adults. Parents should, therefore, allow their children to join the agricultural club movement, and they themselves should join the land service movement which was started in the interests not only of the farming community, but of the nation as a whole. Man reaps what he sows. Let this be a clarion call to you to do national service.

(J. D. de Wet, Senior Professional Officer, Division of Animal and Crop Production.)

New Bulletins for the Farmer.

The following Bulletins have just been published and are obtainable from The Editor, Department of Agriculture and Forestry, Pretoria.

Bulletin No. 192.—"Control of Household Insects in S.A." (2nd Edition): Price 6d.

Bulletin No. 111.—"Dairy Farming" (Fifth Edition): Price 6d.

Bulletin No. 126—"Poultry Houses": Price 3d.

Nursery Quarantines.

The following nursery quarantine was in force on 1 November 1943:—

(1) Beaulieu Nurseries, Forestdale Siding, P.B. Grahamstown, C.P., on citrus (all), for redscale.

Wine-Making on a Small Scale for Home Use.

Prof. C. J. Theron, Director of the Viticulture-Oenology Institute, Stellenbosch-Elsenburg College of Agriculture.

OFTEN inquiries are received for a "recipe" for the making of certain wines. Such inquiries reflect a misconception of the position because wine-making is a biological process which cannot be regulated by the rules of any recipe. The following description is given, however, for the sake of those who have only limited quantities of grapes which they would like to turn into wine for own use, but who have no time to make exhaustive studies of the process. Since the directions have to be simple and brief, no scope is left for dealing with all our well-known types of wine, and only the few considered safest for this purpose are selected. Consequently, theories on wine-making, deviation from the normal process, or a discussion of wine diseases cannot be dealt with here. In fact, the descriptions are so incomplete that they may sometimes land the reader in trouble. In such a case he will have to consult more detailed sources of information in order to discover the mistake. Even so-called "home wine-making" embraces all the processes and problems of commercial wine-making, but the work is executed on a much smaller scale and with simpler apparatus or machinery.

Containers.

Use only containers made of wood, glass, concrete or porcelain. Must and wine should be brought as little as possible in contact with metal, and at any rate never be left for any length of time in metal containers. The must can be fermented in both open and closed vessels, but the wine must always be stored in a closed container, e.g., a wooden cask with bung-hole. New wood should be steamed thoroughly before use, or else repeatedly treated with caustic soda (a spoonful to a gallon of hot water); new cement is washed with fresh grape juice, and even then it is advisable to test the containers with an inferior wine before using them for good wine, as a foreign taste may easily be imparted to the wine. Acid and unsound casks are first treated with caustic soda dissolved in hot water, and then rinsed at least three times with clean, cold water to remove the soda. Immediately after use all the containers are thoroughly cleaned and dried. After that a piece of sulphur tag, enough to fill the cask with fumes, is burned in the wooden cask, the bung inserted and plastered around with tallow. (Sulphur tags are obtained by drawing 1½ inch wide strips of unbleached calico through the purest sulphur heated to a molten state, and these tags are then suspended to dry with just a thin layer of sulphur adhering). This sulphuring is repeated every two months while the cask is not in use. The dry conservation of containers, followed by repeated sulphurings in the case of wooden casks, serves to prevent mustiness and foreign tastes in them. The treatment of musty casks is a difficult process and such casks are, therefore, avoided here. Throughout the wine-making process scrupulous attention must be given to cleanliness, much more so than in cooking, and a vinegar fly should never be seen in the vicinity. Those who are prepared to observe these precautions stand a reasonable chance of obtaining sound, potable wines with the following instructions.

An instrument without which the wine-maker can hardly succeed is a Balling sugar tester for determining the sugar content of the juice when the instrument floats freely in it. It is usually obtainable from one of the larger chemists in Cape Town and costs about 6s. Without this instrument, wine-making becomes too much of a gamble, and the reader will often find it difficult to follow any instructions.

Dry White Wines.

For home-made wines preference is given to White French, Stein and Riesling varieties, but other white ones, with the exception of Hanepoot and Muscadel, may also be used. Allow the grapes to ripen well, immaterial of the sugar content. Use only sound bunches, crush them with the hands or feet and strain through a sieve or coarse hessian, thoroughly cleansed beforehand, to separate the juice from the skins. Press the skins by hand, or where available, with a small press to expel the juice. There is no further use for the skins, but all the juice is put into a vessel, previously sulphured with a sulphur tag as described, for fermentation. For this purpose a closed cask is preferable. The cask is made ¾ full and the bung-hole covered with paper folded about 4 times and weighted with a flat stone or brick; as a rule fermentation sets in on its own accord in a day or two. If this is not the case, the juice must be inoculated with a good strain of wine yeast obtained from some cellar or wine laboratory. If the cask is left in a well-ventilated and cool room, there is little danger that the temperature of such a small quantity of must will run too high. It is, however, desirable that this shall not rise above 87° F. or 30° C. This can be prevented by pressing the cold grapes of the early morning, but where the fermentation is slow in commencing, the grapes should not be taken too cold, especially not the first batch of the season.

During fermentation it will be seen that the Balling reading of the must which initially showed perhaps 22° (quite sufficient for this purpose), is gradually dropping. When the fermentation is complete it will register about minus 1½°. If the fermentation becomes very slow and the meter still shows plus 1 or more degrees of sugar, it may get stuck. This may be prevented by shaking the cask or running out some of the contents and pouring it back in order to stir up the sediment or lees containing the yeast cells and aerate the must. This usually revives fermentation and all the sugar is changed to alcohol. If this does not happen, the result is a natural sweetish wine. Such a wine is more subject to diseases and should be taken extra care of. On the other hand, when still sound, it usually tastes better than dry wine. If the must had an open fermentation, it should be brought to a closed cask when the fermentation subsides, and treated as described above.

Dry Red Wines.

In this practice the red wine is of less importance than the white, and Hermitage is about the only variety that comes into consideration. Table grapes produce very inferior wines which are really only fit for vinegar. The grapes, fully ripened and well coloured, are crushed as stated before, but here most of the stalks are removed as the must now ferments on the skins for the extraction of the colour. For this purpose an open container is used, but it is desirable to close it with a lid or tarpaulin. Sulphur the vat strongly beforehand, again fill it about ¾ and start the fermentation as before. After some time the husks will form a head on top, which from now on must be regularly pressed down deeply into the juice at least 4

times per day. When fermentation subsides (plus minus 5° Balling) the wine is separated from the husks, taken to a cask, the husks pressed out, the press-wine added to the taste-wine and the fermentation completed as in the case of the white wine.

Treatment of Young White and Red Wines.

The wines are stored in a clean, cool place with a very uniform temperature. The fermentation is encouraged, as described above, to develop completely. A week after the active liberation of gas has ceased, the first racking is given. This is done by putting a suitable rubber tube into the top of the cask and siphoning over the wine. Now carefully lower the tube in the cask until it just begins to siphon over lees. In this way all the fairly clear wine is drawn off while the sediment remains behind. The cask is then rinsed with cold water until the water runs off clearly. Let it dry off for a few minutes, sulphur and pour back the wine. The cask is now filled to the top, fitted (not too tightly in case of refermentation) with a fairly long bung and plastered with tallow. The best maturation is always obtained in wooden casks. The racking is repeated in a clean sulphured cask for a second time about 3 weeks after the first and for a third under similar circumstances as the second, in August. At the 2nd and 3rd rackings the wine is already clear and carefully separated from all the lees at the bottom of the cask.

If light wines are exposed to air contact, i.e., when the cask is no longer full to the top, they may easily turn acid. This is prevented by filling the cask regularly every week. An air space arises in the cask as a consequence of contraction of the wine in cold weather and also of evaporation through the pores of the wood. The latter is essential for maturation and, therefore, wine matures so slowly and incompletely in cement or glass. The best way of providing filling wine in this system is by bottling some of the clearest wine on top of the cask at the first racking, and later on filling the cask weekly with the bottles. If the casks are not filled up regularly, too much is left to chance to keep them sound. Filling wine is, therefore, required to compensate both for evaporation and the loss of lees at the 2nd and 3rd rackings, and for a hogshead (63 gallons) one may easily require 5 gallons for the first year. From this it can roughly be deducted what quantity of wine should be fermented in order to fill a certain cask and also for filling it up subsequently. The quantity of lees at the first racking is considerably more than that of the second or third, and has not been included in the 5 gallons mentioned above. When the wine is kept for more than one year in the cask, it gets a further racking in the winter of the second year, is still filled up regularly, and consequently requires a bigger quantity of filling wine than that stated above.

Bottling.—White wines are usually in a fit condition to be bottled with advantage at 8 months of age. Use clean, dry bottles, and in filling them try to ensure that the wine does not come into unnecessary contact with the air, use good quality corks, and in filling the bottles leave not more than ¼ inch air space in the neck of the bottle. Store the bottles in a cool place, laying them flat so that the cork remains wet, and do not commence consuming the wine until one month later. Red wines take longer to develop a smooth taste; they should remain for at least one year or preferably 1½ years in wood, before being bottled, as described above.

Sweet Wine.

Although most people prefer making sweet wine, its manufacture is for the following reasons more difficult to execute on a small

scale. Sweet wine must be fortified with spirits or brandy as follows: Suppose the must contains 24° Balling, let it ferment in the usual way to 12° Balling, which leaves enough sugar in the wine for most palates, and fortify to 30° proof spirit to check further fermentation. In this case one requires 18½ gals. of brandy of 10° overproof and 81½ gals. of partially fermented must for 100 gallons of sweet wine of the required alcoholic strength. (For other strengths of must and brandy the quantity of brandy should be varied in proportion.) Not only has such a fortification to be done under Excise supervision, but special consent of the Excise Department must be obtained beforehand for fortifying quantities of sweet wine less than 300 gals. All this can still be undertaken by those who distil their own brandy, but when the brandy (or spirit) has to be purchased from a wine merchant, the cost involved is so high that in most cases it will pay better to buy a good sweet wine ready made. For these reasons the above system is considered impracticable for wine-making on a small scale and not further discussed.

There is, however, another aspect of sweet-wine making that may interest the small-scale operator. The wines produced here are recommended only for own use, as they will often not comply with the requirements of the Act for the sale of wine. It has already been stated that no further fermentation will take place in a wine of 30° proof spirit. This strength can be obtained by the complete fermentation of a must of 30° Balling—the maximum sugar that can ferment out. If the must has more than 30° Balling, all the sugar can, therefore, not ferment out and the result is a natural sweet wine without fortification. (The fermentation can, however, also stop at considerably less than 30° P.S. in which case the alcohol will be too low to safeguard the wine sufficiently against disease.) Grapes normally seldom reach 30° Balling and more, but there are two ways of increasing the degree with sugar of the grape. Practically any variety that attains a high sugar content may be used here, and for obtaining a pleasant sweet wine the original must should have at least 24° Balling.

1. Concentrate the juice by boiling to the consistency of ordinary grape syrup (plus minus 70° Balling) and add it to the must of 24° Balling until the blend shows, say, 36° Balling. Now ferment in the ordinary way as far as possible until the fermentation stops with at least 6° Balling still remaining. It is very risky to add only grape syrup to dry wines and not recommended unless where the wine is to be consumed immediately.

2. Twist the stalks of the bunches to shrink on the vine, or put them on trays in the sun until in either case the sugar content of the juice has reached 36° Balling before crushing. The berries are now rather tough and should be well bruised when crushing—tramping by feet is best. The musts of (1) and (2) are fermented in the same way and similar to the method for red wines, viz., in a well sulphured cask and the husks pressed down regularly. Fermentation takes place on the skins until it slows down in the case of red wine, and somewhat earlier in the case of white wine, when the wine is drawn off, the husks pressed out and all the wine fermented together in a cask. By aeration and stirring the fermentation is encouraged to continue as far as possible, because the more sugar that ferments out, the better are the chances that the wine will remain sound. The wine is racked in the same way as the dry wines, viz., thrice, each time in a well sulphured cask. If it had a normal fermentation and is fairly high in alcoholic strength, it need not be kept in a full cask,

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Termites in Farm Lands and Gardens.

Dr. Bernard Smit, Senior Entomologist, Division of Entomology, Pretoria.

IN discussing termites, often wrongly called white ants, it is necessary to emphasize the difference between these insects and true ants in order to avoid the constant confusion that so often exists in regard to these two very distinct groups of insects.

Africa has been called the home of termites, and in South Africa alone there are over a hundred different species. In some parts the veld is dotted with their mounds (called ant-heaps) as far as the eye can see. Marshall has said that they are the worst insect pest we have, because their work of destruction is so universal and goes on continuously, although it is very insidious and we do not usually see it until much damage has been done.

Two Groups of Termites.

In South Africa there are two distinct groups of termites: (1) the fungus growers, which cultivate special mushroom beds on spongy cakes of specially prepared wood pulp and (2) the harvesters, which do not cultivate fungus. The fungus growers work in secret, away from the light and they cover their runaways with soil. They are the ones that chiefly attack woodwork in houses. The harvesters cut off and collect grass and they work in the open during the daytime. They are larger than the others, but their nests are made well below ground and there is no mound or " ant heap " to show where the nest is.

In a termite nest there is usually only one queen and one king, which live for several years and there are a number of supplementary kings and queens, which have wings and can fly when the need arises. These are fully developed males and females and may either take the place of the original king and queen in case they are killed, or they may issue from the nest as flying termites at certain seasons of the year and fly away to start new colonies. In colonies of true ants, on the other hand, there are usually a number of egg-laying queens.

The workers are asexual. It is their duty to do all the ordinary work of the nest. They enlarge it and build the fungus gardens. They gather food and feed the king and queen and the soldiers. They look after the eggs and feed the young and keep the whole nest scrupulously clean.

The soldiers arise from special eggs laid by the queen and they do no constructive work in the nest. The only function of the soldiers, which usually have very large heads and jaws, is to defend the nest as occasion arises.

In true ant colonies, the workers are all females, and the males, whose only function is to fertilize the queens, soon disappear. On the other hand, termite workers and soldiers consist of undeveloped males and females in about equal proportions, while the fully developed male, called the king, lives with the queen for a number of years. When conditions are favourable, a termite colony may continue in the same nest for ten or twenty years.

The food of true ants consists mainly of other insects and animal remains and, in some groups, of sweet substances such as honey-dew, sugar and sweet food stuffs.

Termites, on the other hand, live on cellulose which they get from dried vegetable material such as wood and straw. They do not usually attack the living tissues of plants, especially when plants are in a vigorously growing condition. Termites have a marvellous and unique method of digesting their food which would normally be most resistant to such a breaking down process. The woody material is chewed into a pulp and in the alimentary canal is acted upon by certain specific protozoan organisms which decompose it and turn it into a digestible food. This is then regurgitated and fed to the royal pair, the soldiers and the young. In the case of the fungus growers, the partially digested wood pulp is formed into a damp, sponge-like mass, called a fungus garden, in which a special species of mushroom is cultivated. Under the care of the workers, this spawn produces special button-like "fruiting" bodies and upon these the young termites feed. Amongst the fungus growers we find the worst of our wood-destroying species.

Control of Termites.

For the control of termites, it is necessary to distinguish between fungus growers and harvesters because, while the former have to be destroyed by directly attacking the nest, the latter can be controlled by giving a poisoned bait to the workers on the surface of the soil.

For fungus growers, the first step is to find the nest and this is most easily done before the ground is disturbed. In old gardens there is usually no indication as to where the nest may be, although sometimes it may be found under a hedge, or in trenching or digging holes for new fruit trees it may be found accidentally. In such a case steps must be taken to exterminate the whole nest as completely as possible. It is no use merely digging out the queen because the supplementary kings and queens will develop to take her place and then there may finally be several nests in the place of the original one. Do not disturb the nest more than is necessary, but push a crowbar or fencing standard into it, so as to make a hole right down into the centre and then pour from one to six pints of petrol or half to three-quarters of a pint of carbon bisulphide into the nest. Do not light this but plug the hole immediately and allow the liquid to evaporate and the fumes to diffuse throughout the nest.

When the nest cannot be found, a main gallery, at least half an inch in diameter and leading into it, must be discovered. This can sometimes be done by scratching away workings with the finger or by watching for the emergence holes of the flying termites after spring rains. Such a gallery may run for 20 or 30 feet into the nest and the termite pump must be used to force poisonous fumes through it to the nest. This contrivance consists of an air pump, something like a big tyre pump connected to a brazier in which a charcoal fire is made. When the fire is glowing red, a mixture of white arsenic and sulphur is thrown on to it and the resulting fumes, which form a thick, yellow smoke, are pumped into the nest through a flexible tube. The powder is made by mixing 3 lb. of white arsenic with 1 lb. of sulphur and for a large nest about two tablespoonfuls of the mixture are used. In addition to killing most of the insects directly, the fumes deposit a white layer of arsenic over the fungus gardens and in the nest cavities, so that the nest cannot be reinhabited and is entirely exterminated.

When fruit trees or rose bushes are first planted, termites often attack the roots and kill the trees before they can establish themselves. In order to prevent this, a repellent can be used and the

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Peach Packing Experiments conducted during the 1942-43 Season.

T. Micklem, D. du Preez and Dr. M. W. Black, Pomologists, Western Province Fruit Research Institute.

MOST dessert peaches cultivated in the Western Province are of the white fleshed variety. The fruit is tender, and highly susceptible to bruising, both during picking and packing, and when in transit to market. It is an established fact that when these peaches are sent to distant markets careful handling and packing methods have to be used, to ensure that the fruit will travel well.

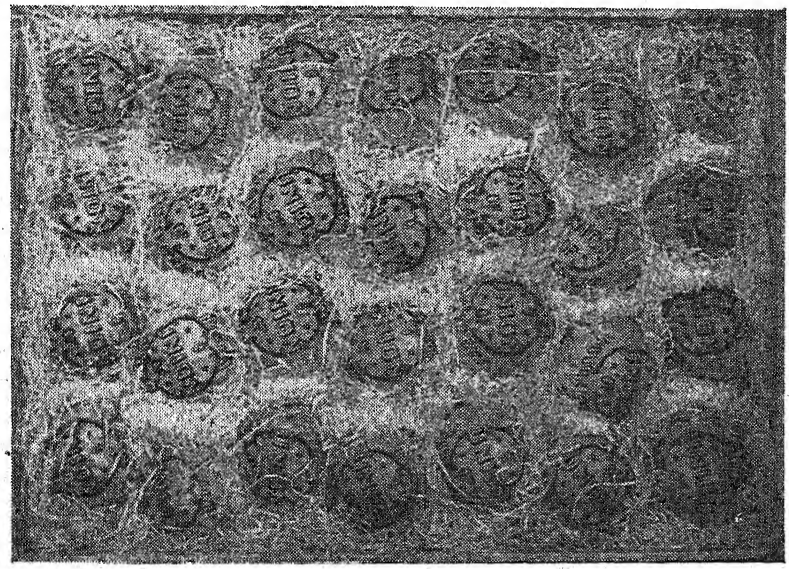

FIG. 1.—Nest pack wrapped.

In analysing the packing methods at present employed in the marketing of peaches in South Africa, a general lack of uniformity was found. Apart from the old export pack, the Deciduous Fruit Board have latterly introduced new methods of packing, whereas outside of this organisation the grower can pack peaches in a variety of ways allowed by the local marketing regulations.

At the present time there is an acute shortage of box-wood, and other packing material such as woodwool, wrappers, etc., whilst the cost of container in relation to the value of the fruit has increased considerably since the outbreak of the war.

Under these circumstances it was felt essential to determine experimentally the cheapest and most efficient methods of packing peaches for marketing in South Africa, and to standardise these methods, according to size of fruit. Experiments were conducted during the past season and although further investigations are necessary, it is felt that the results, coupled with past experience in the packing of peaches, justify the publication of the data at this stage.

Experimental Technique.

When considering ways of packing, it was decided that the standard wooden tray (18 in. by 12 in.) was the only available type

of container that met the purpose. In order, therefore, to bring down packing costs, the use of cheap substitutes for woodwool, and packs where fruit was not wrapped, were concentrated on. Other indirect ways of bringing down packing costs were to use trays as returnables, and to develop packs which permit more fruit to be packed per tray.

Eight batches of peaches were packed, and stored in different ways. Comparative samples were examined at Stellenbosch and at Johannesburg in most cases. The varieties used, place of origin and range of the various shorage treatments are indicated in Table I. Comparing results obtained at Johannesburg with those at Stellenbosch, the suitability of the different packs for both distant and nearby marketing could be gauged.

In each consignment a wide range of different packing treatments was tested, as far as possible unsatisfactory methods being discarded as the season advanced. As a basis three different packs were used:—

TABLE I.

Variety.	Area.	Storage Treatment.	Place of Examination.
Early Dawn.	Bien Donné Groot Drakenstein.	5 days at 35° F. (S), then ripened for 3½ days at room temperature.	Stellenbosch.
„	„	6 days at room temperature..................	Stellenbosch.
Inkoos......	„	5 days at 35° F. (S), then ripened for 3 days at room temperature....................	Stellenbosch.
„	„	5 days at room temperature................	Stellenbosch.
Peregrine...	Eikenhof Elgin.	3 days at 35° F. (S) then ripened for 3 days at room temperature.......................	Stellenbosch.
„	„	3 days at room temperature................	Stellenbosch.
„	„	1 day in cold store (T.B.D.), examined 3 days later (per cold truck)..................	Johannesburg.
„	Bien Donné Groot Drakenstein.	10 days in cold store (T.B.D.), examined 1 day later...................................	Stellenbosch.
„	„	10 days in cold store (T.B.D.), examined 3 days later (per cold truck)..............	Johannesburg.
Elberta.....	„ 1st Consignment.	10 days in cold store (T.B.D), examined 1 day later..........................	Stellenbosch.
„	„	Direct per hot truck.....................	Johannesburg.
„	„	10 days in cold store (T.B.D.), examined 3 days later (per cold truck)...........	Johannesburg.
„	„ 2nd Consignment.	5 days in cold store (T.B.D.), examined 1 day later..........................	Stellenbosch.
„	„	5 days in cold store (T.B.D.), examined 3 days later(per cold truck)...........	Johannesburg.
„	Eikenhof Elgin.	15 days in cold store (T.B.D.), examined 1 day later............................	Stellenbosch.
„	„	15 days in cold store (T.B.D.), examined 3 days later (per cold truck)...........	Johannesburg.

S. = Stored in cold chambers Western Province Fruit Research Institute, Stellenbosch.
T.B.D. = Stored in cold chambers Table Bay Docks, Cape Town.

(1) *Nest Pack.*—Woodwool, or substitute between rows, and between fruit in the row (Figs I and II).

(2) *Semi-nest Pack.*—Woodwool or substitute between rows, but not between fruit in the row (Figs. III and IV).

(3) *Solid Pack.*—No woodwool or substitute material between rows, or fruit in the row (Figs. V and VI).

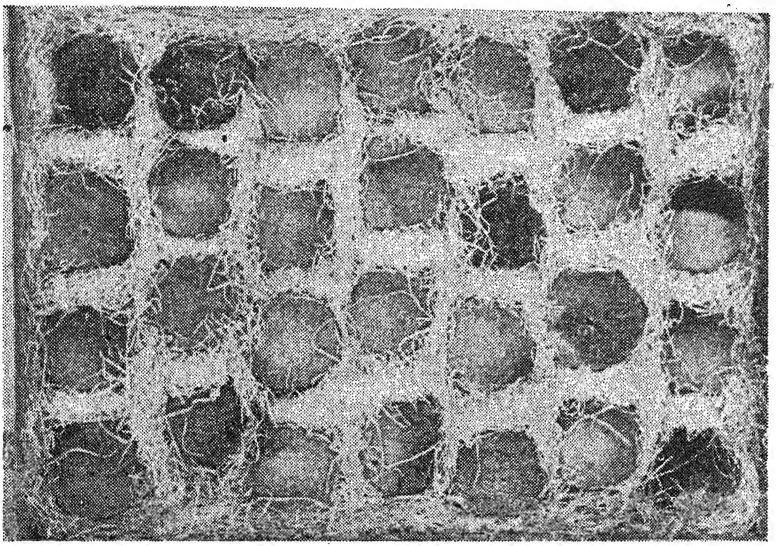

FIG. 2.—Nest pack unwrapped.

These three packs were repeated with wrapped and unwrapped fruit, in single, double and occasionally in triple layer trays. The performance of substitutes for woodwool was also tested over a range of the above packs. These substitutes included sisal, white corrugated paper, greenkraft, Poplar sawdust, fine and coarse sawdust and shavings of *Pinus Insignis* and *Pinus Pinaster*, oat straw and rolled oat chaff. Small grades were also packed in Californian Bushels, while the use of paper cover sheets was tested.

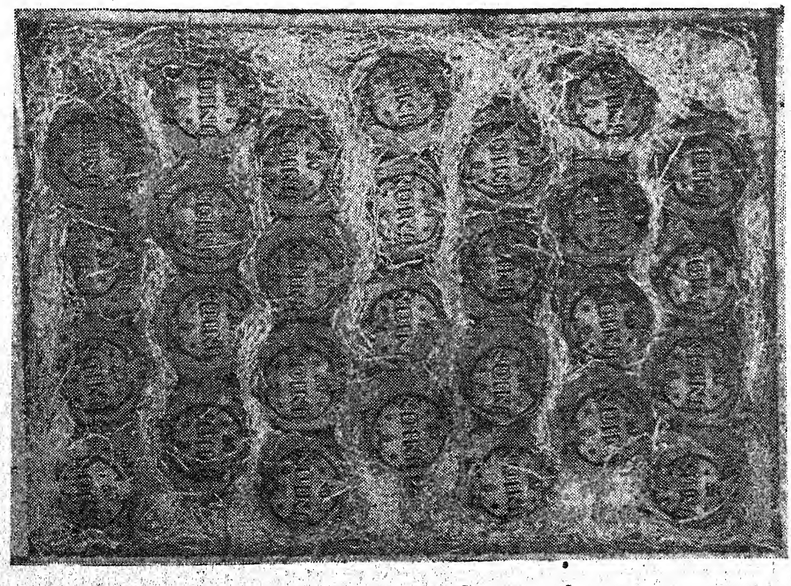

FIG. .3—Semi-nest pack wrapped.

Results of Packing Experiments.

For the purpose of this report, a tabulation of all results obtained would be far too bulky, and only the more important findings will now be given:—

(1) *Wrappers and top sheets.*—It was found that peaches need not necessarily be wrapped, but that if they were not wrapped, then the use of a cover sheet of paper between fruit and top pad was advisable. While wrapped packs had a neater appearance than unwrapped ones, the quality of the fruit remained the same in packs 1 and 2. Sometimes when fruit was sent to Johannesburg, unwrapped peaches had a dusty appearance on arrival, but this was partially controlled by the use of a top sheet. With packs examined at Johannesburg, there were indications that unwrapped peaches packed in woodwool ripened quicker than wrapped ones.

(2) *Substitutes for woodwool.*—Sisal proved an excellent substitute for woodwool, provided fruit was not cold stored. When fruit was cold stored, the sisal compacted and tended to slip out of position, resulting in bruising. This tendency to slip out was accentuated by the fact that the sisal had not been chopped into short enough lengths.

All the other substitute materials proved highly efficient as padding agents, and controlled bruising, but in their present form can be discarded from peach packs for the following reasons:—

(i) Pine sawduct and shavings gave fruit a strong obnoxious foreign flavour, and made unwrapped fruit dusty.

(ii) The use of oat chaff and straw led to a high percentage of the fruit becoming infected with Rhizopus rot.

(iii) Poplar sawdust made fruit dirty.

(iv) All types of paper liners, as compared with woodwool, proved inefficient as padding material and bruising resulted. The trade was not in favour of sawdust packs, as on removal for inspection it was found impossible to replace the fruit, and difficulty was experienced in displaying these packs effectively.

(3) *Type of container.*—The single layer tray was the most efficient type of container used. Deeper trays in which two and three layers of peaches were packed, were only suitable when expensive wrapped and unwrapped nest packs were used. Bushel containers in which four and five layers of small fruit were packed, were disappointing and caused bruising and rapid ripening, especially when sent to Johannesburg.

(4) *Pack.*—In judging whether a certain pack was a success or not, bruising was used as a criterion. Any pack which consistently led to more than 10 per cent. bruising was discarded.

(*a*) *Nest Pack.*—This pack was highly effective, and completely controlled bruising of wrapped and unwrapped peaches in single and double layer trays.

(*b*) *Semi-nest Pack.*—An efficient pack for wrapped and unwrapped fruit in single layer trays, provided that fruit was not overripe, or packed too tightly in the row. This pack was unsuitable for double layers.

(c) *Solid Pack.*—When fruit was wrapped in single layer trays, the solid pack was a great success, provided that the fruit was not overripe, or the pack too tight. When fruit was unwrapped, this pack was unsuitable for white fleshed peaches and even with the yellow fleshed Elberta caused some bruising. This pack was totally unsuited for multiple layer packs.

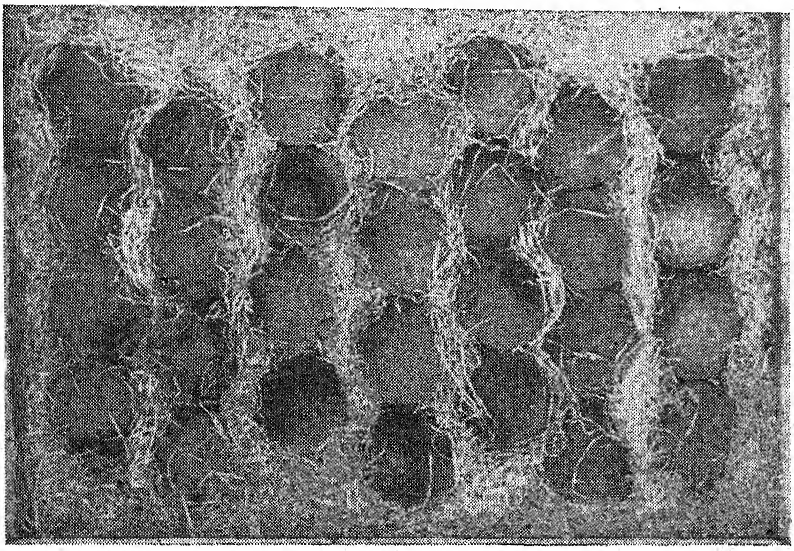

FIG. 4.—Semi-nest pack unwrapped.

(5) *Transport.*—Judging from the appearance of experimental batches of peaches, it would appear that this commodity should receive more careful handling, both in transit and on the markets. It is possible that with more careful handling, packs which caused excessive bruising in these experiments would prove suitable. In America the double layer wrapped peach pack is commonly used, and the containers are not even lined with woodwool. Even with the Elberta peach, such a pack resulted in an excessive amount of bruising.

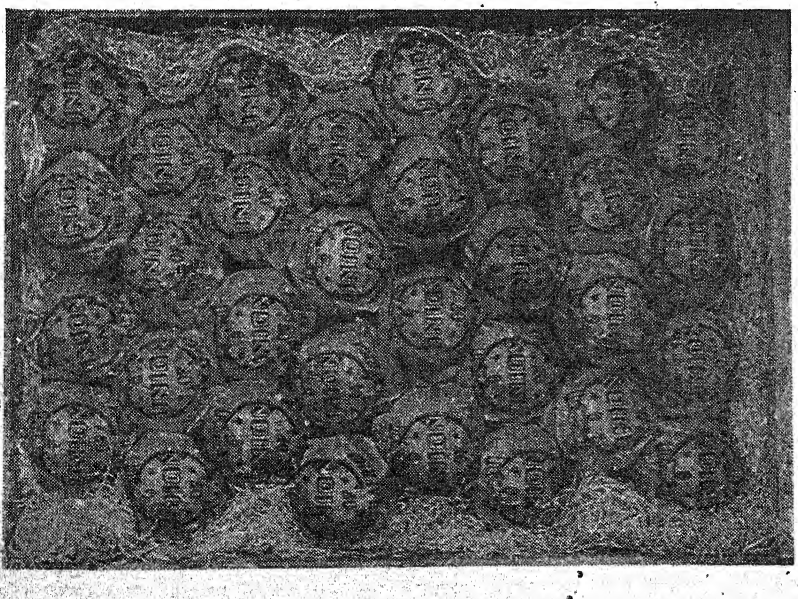

FIG. 5.—Solid pack wrapped.

Standardisation.

For the successful marketing of any fruit, standardised contains, grade sizes, packing methods, and counts or weights are essential. When peaches were exported, standardisation was enforced, and overseas buyers could rely on our peach packs fulfilling certain requirements. In the case of local marketing, however, a chaotic mixture of packing methods have been in use.

In order to arrive at standard packs, etc., data was collected during the past season from three commercial packsheds and compared with experimental results. A standardised range of peach packs arrived at from this preliminary study is now presented in Table II.

TABLE II.—*Peach packs and counts.*

Actual grade Diameter in inches.	Nest Pack.		Semi-nest Pack.		Solid Pack.		Box size.
	Pack.	Count.	Pack.	Count.	Pack.	Count.	
2	—	—	5 × 4 × 9	41	5 × 5 × 10	50	$2\frac{1}{2}$
$2\frac{1}{8}$	4 × 4 × 8	32	5 × 4 × 8	36	5 × 5 × 9	45	$2\frac{3}{4}$
$2\frac{1}{4}$	4 × 4 × 7	28	4 × 4 × 8	32	5 × 4 × 9	41	$2\frac{3}{4}$
$2\frac{3}{8}$	3 × 4 × 7	24	4 × 4 × 7	28	5 × 4 × 8	36	3
$2\frac{1}{2}$	3 × 3 × 7	21	4 × 3 × 7	25	4 × 4 × 8	32	3
$2\frac{5}{8}$	3 × 3 × 6	18	3 × 3 × 7	21	4 × 4 × 7	28	$3\frac{1}{4}$
$2\frac{3}{4}$	3 × 3 × 5	15	3 × 3 × 6	18	3 × 4 × 7	24	$3\frac{1}{4}$
$2\frac{7}{8}$	3 × 2 × 5	13	3 × 3 × 5	15	3 × 3 × 7	21	$3\frac{1}{2}$

It will be seen that in the case of the nest pack, which is equivalent to the old export pack when fruit is wrapped, that the old 25 count has been done away with, while the diameter grades increased regularly by $\frac{1}{8}$ in. This is thought to be an improvement on the old export regulation whereby the actual grade diameter increases as follows:—

$2\frac{1}{8}$ in., $2^3/_{16}$ in., $2\frac{1}{4}$ in., $2\frac{3}{8}$ in., $2\frac{1}{2}$ in., $2\frac{5}{8}$ in., $2\frac{3}{4}$ in., the counts packed for these sizes being 32, 28, 25, 24, 21, 18 and 15.

With the semi-nest pack, the packs used at the different packsheds were mainly in accordance with results obtained in this study, and can therefore be taken as standard.

In the case of the solid pack the counts arrived at in this study were all a count down on those given in Table II. The reason for this was that with experimental packs the boxes were well padded with woodwool on sides and ends, whereas to arrive at the counts given above, commercial growers used woodwool sparingly around sides and ends of boxes.

An important point to remember when studying the data compiled in Table II, is that the actual grade diameters are used. In the past the growers allowed $\frac{1}{8}$ in. increase in each grade in the case of export fruit, to allow for shrinkage which occurred before inspection at the docks. Results in this study have shown that the Elberta peach does shrink $\frac{1}{8}$ in. in diameter on storage at room temperature, for 48 hours. However, it is felt that it would be less confusing if the fruit inspectors allowed for this shrinkage instead of the grower.

Recommendations.

(1) For marketing of peaches on South African markets, either the semi-nest unwrapped single layer, or the solid wrapped single layer packs should be used. Both packs proved efficient in this

study for nearby and distant markets. With the former pack there is 100 per cent. saving in wrappers, while with the latter pack 25-30 per cent. more peaches can be packed per tray than when using the former pack. It would appear, therefore, that if the wrappers are available and if a price increase relative to the increase in the number of fruit packed in the solid pack method were obtained, then this pack would be the most economical. On obtaining the opinion of the trade on the Johannesburg market, it was found that they

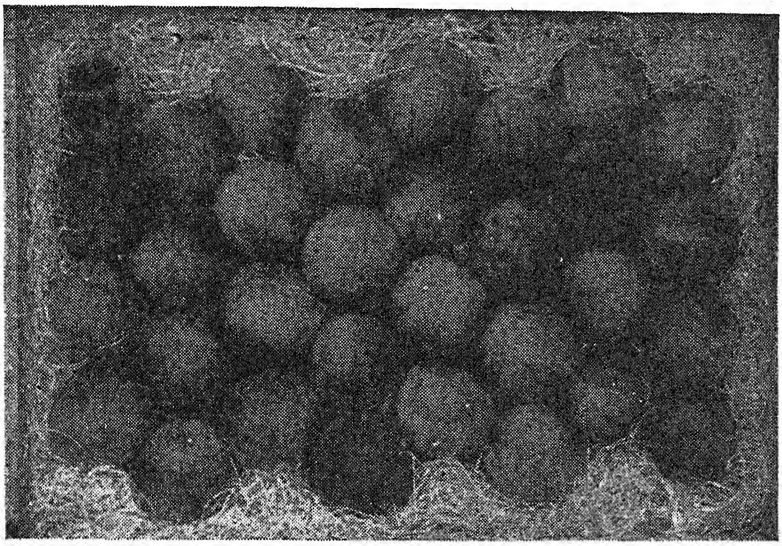

FIG. 6.—Solid pack unwrapped.

were in favour of this solid pack. They objected to the space wasted in the tray where other packing methods were used.

(2) Standardised packs (see Table II) should be used.

(3) If possible, more careful handling in transit, and on markets should be enforced.

It must be remembered that these recommendations are made after only one season's work, and it is felt that more work should be done on peach packing. It is thought probable that in the future further improvements in methods of packing could be achieved.

Acknowledgement.

The cost of containers and packing materials were mainly defrayed by a grant from the Deciduous Fruit Board, who also arranged for storage facilities to be made available at the Table Bay Docks. The authors would also like to express their appreciation of the work done by Mr. N. H. van der Meulen of the Division of Economics and Markets, who helped Dr. M. W. Black in the examination of the fruit on arrival at Johannesburg. Thanks are also due to H. W. Blackburn, Esq., Elgin, for allowing the Elgin shipments to be packed in his packshed, and for supplying data on packing counts, and to Rhodes Fruit Farms Ltd., and Pickstone & Son, Groot Drakenstein, for supplying data of a similar nature.

Wine-making on a Small Scale for Home Use :—

[Continued from page 870.

but the bung-holes should at any rate be well closed and the wine not unduly exposed to the air. At 9 to 12 months the wine should be in a fairly fit condition for bottling.

Vinegar for Own Use.

For this purpose any variety, even those low in sugar, like table grapes, may be used, provided the grapes are soundly ripened. The grapes are fermented as described above, to sound dry wines, white or red. The fermentation must be completed before acetification commences. At the first racking the wine is then added to the vinegar cask, and where this does not yet exist, the acetification is started as follows: Use any type of cask, store it in a fairly warm room, fill it not more than ¾ with light wine and close with a loosely fitting bung, unplastered, or a plug of cotton wool. When freely exposed to the air at a fair temperature, light wines usually turn sour on their own account in a short time. If this is not the case, acetification is started by inoculating the wine with a small quantity of good young farm vinegar still containing large numbers of living bacteria. After a few months the result is bound to be a good vinegar. The vinegar cask is never sulphured as this retards acetification. Every year some vinegar is left to inoculate next year's wine of the first racking. About every second year the vinegar cask is racked, the lees well rinsed out with cold water and the vinegar poured back. Should some disease develop in the vinegar, a very rare occurrence with this system, the cask is rinsed with clean water, then repeatedly with caustic soda, followed again by clean water and the whole process started very carefully with sound wine as before. It is not desirable to have the vinegar cask close to the wine, as its germs can easily infect the latter.

Termites in Farm Lands and Gardens :—

[Continued from page 872.

best substance for this is copper sulphate (bluestone). Plant the trees in the ordinary way and round each make a small furrow about three inches deep and eighteen inches away from the stem of the tree. In this scatter 4 ounces of powdered copper sulphate all round the tree and fill in the furrow to bury it. Then water the tree and the chemical will be dissolved and carried down into the soil. As it is very soluble, it will gradually be leached away by rainwater, but it will remain long enough to keep the termites away until the tree can become established. Lawns and flower beds can be protected by the same method, only in this case the copper sulphate should be dissolved in water, using 1 lb. in 20 gallons, and the infested areas should be well watered with this solution.

In general, plants growing vigorously are less subject to attack than unhealthy plants and proper culture in the garden goes a long way towards controlling termites.

For controlling the harvester termites, or non-fungus growers, a very effective bait has been devised. Most people have watched these insects dragging pieces of dry grass to their holes around which they are stacked before being carried down into the storage chambers below. If such pieces of grass are poisoned and scattered where the harvesters are working they will carry them down in the usual way and feed the chewed up material to the members of the colony. In this way, the whole nest is gradually eradicated. Hard, dry grass is cut into pieces of about an inch long with a chaff cutter.

[Continued on page 882.

Diagnosing Cases of Poisoning.

Dr. Douw G. Steyn, Onderstepoort.

YEAR after year thousands of specimens are received at Onderstepoort in connection with suspected cases of poisoning. It is obvious that the investigation of so many specimens demands considerable time and trouble. Every effort is made to carry out the investigation as thoroughly as possible, but many specimens are received in such an unsatisfactory condition that a thorough investigation is out of the question, with the result that not only the time of the officers at Onderstepoort, but also that of the consignor or owner of the animal concerned, is wasted. Moreover, in many instances the specimens are required as exhibits in court cases and must consequently serve as material evidence. It is obvious, therefore, that the taking and dispatch of specimens in the correct manner as described below, is of the utmost importance.

Specimens for Investigation.

All specimens of animals suspected of having been poisoned, and specimens suspected of containing toxic substances must be forwarded to the Director of Veterinary Services, Onderstepoort, Pretoria North Station, for investigation.

In every case of suspected poisoning all of the following specimens should be sent:—

(*a*) Liver, ruminal contents, bone and skin. In the case of large animals each specimen of the above organs should weigh *two pounds*, and in the case of small animals the entire stomach, together with the intestines and their contents, as well as the whole liver, should be sent. In the case of poultry the crop and its contents should be included. Of the bones, the two thigh bones (2 lb.) should, if possible be included. No *preservatives* should be added to these specimens.

(*b*) Any substance (soil, water, feed, etc.) suspected of being toxic.

(*c*) Liver and brain in 10 per cent. formalin. Of the liver, pieces as large as one's thumb should be placed in the formalin. The head must be sawn through lengthwise in the middle and one-half of the brain placed in the formalin. Formalin is obtainable from chemist shops.

(*d*) *Blood smears and, if possible, also spleen smears, should be forwarded in all cases.*

(*e*) In the case of sick animals, dung (1 lb.), hair (3 to 8 ounces), urine (1 pint) and blood smears should be submitted.

If the above specimens are available for examination and analysis, diseases like redwater; gallsickness; anthrax; heartwater; paratyphoid in calves; senecio, lead and arsenical poisoning, etc., can be diagnosed. During the past year cases of severe scouring in cattle repeatedly occurred and it was often very difficult to determine whether the trouble was due to heartwater, starvation or poisoning. That is why it is so essential to have specimens of the brain in formalin, which is obtainable from chemists.

Geilsiekte.—In order to diagnose geilsiekte (prussic acid poisoning) the following procedure must be adopted. In each of two bottles 100 c.c. of 1 per cent. corrosive sublimate (bichloride of mercury) should be placed.

The corrosive sublimate solution is obtainable from chemist shops. *N.B.*—It is extremely poisonous, should be labelled as such and be locked away.

Into one of the bottles bits of the liver ($\frac{1}{4}$ inch cubes) should be dropped until just covered with the sublimate. In the other bottle solid ruminal contents (i.e., contents of the large stomach of ruminants) should be dropped until just covered with the sublimate. Plants to be examined for prussic acid should be forwarded in the same manner.

Water poisoning.—Two large wine bottles of the suspected water are required for a proper investigation.

Plant poisoning.—Suspected plants together with their bulbs, flowers and fruit should be packed between sheets of newspapers and cardboard and forwarded for identification.

The Covering Letter.

It is *absolutely essential* (1) that each specimen should be sent in a separate container, preferably a well-cleaned canned-fruit bottle; (2) that each specimen should be clearly numbered and marked with the name and address of the sender and; (3) that the nature of the contents and the name and address of the owner should be stated on the wrapper of the parcel. In addition, the covering letter should contain a full description of the history of the disease, the symptoms and post-mortem lesions, and all the possible information in connection with the feed, grazing, licks, etc., of the animals concerned. *This letter must be sent by post and not be included in the parcel.*

Bulletins on the above and other stock diseases are obtainable from the Director of Veterinary Services, Onderstepoort.

A fee of 2s. is charged only for specimens which are submitted for *chemical analysis.* All other specimens are examined free of charge. If more than one specimen is submitted from the same animal they are regarded as one specimen and only 2s. is charged for the analysis.

Warning.

It is most important that specimens of internal organs, water, etc., which are forwarded by rail or post, should be thoroughly packed in properly-cleaned fruit bottles or tins. Such containers must then be packed in boxes containing sufficient sawdust, grass or straw to prevent breakage. If containers are broken in transit they are simply thrown away by post or railway officials since they contaminate everything with which they come into contact. On the parcel should be written " Glass—with care ". Furthermore, specimens of internal organs should not be conveyed to Onderstepoort in bags by motor.

Termites in Farm Lands and Gardens :—

[*Continued from page* 880.

A solution of poison is then made by dissolving one pound of arsenite of soda and eight pounds of sugar in eight gallons of water and in this the grass is soaked for a few minutes, just long enough to thoroughly wet it. It is then dried in the sun and is ready for use. Field tests on a large scale have proved this method to be very effective when the bait is broadcast at about one bag per acre.

The Farm Home.

(A Section devoted mainly to the interests of Farm Women.)

Dressing of Sheepskins for making Articles.

Miss I. van Schalkwyk, Home Economics Officer, Department of Agriculture and Forestry.

THE dressing and use of sheepskins for the manufacture of serviceable articles is an art which has been practised since time immemorial.

In selecting sheepskins, it is important to take into account the object for which they are intended. For toys, tea cosies, slippers, etc., skins with a ¼ to ½ inch length of wool are most suitable, while for floor mats a wool length of ½ to ¾ inch is better. A skin of which the wool is not very dense can easily be dressed, and gives much better results when dyed. Skins with coarse wool are preferable to those with fine wool, provided there is no kemp (hair) among the coarse wool.

Select skins which have been carefully removed from the carcass, i.e., they must be free from cuts, tears, thick ridges or other defects.

Preparation.

Remove all fat from the suède side of the skin by scraping or pulling it off with a blunt knife. A piece of sandstone is also very effective for this purpose.

Dry, salted skins must be soaked in water for 12 hours before being washed. If skins are not well soaked, it is difficult to soften them until quite soft later on.

Newly flayed skins may also be used, in which case a soaking of 1 to 2 hours will be sufficient.

Rinse the skins thoroughly after the soaking process and then soak them again for 1 to 2 hours in soap water to which one tablespoonful of ammonia has been added for every gallon of water. Rinse the skins once more and then wash them thoroughly in a good soap solution to which one tablespoonful of ammonia for every gallon of water has again been added; the ammonia helps to loosen the grease and facilitates the washing process. The soap solution can be made by dissolving soap in water at the rate of ¼ lb. soap to 1 quart of water. Grate the soap, or slice it and add hot or boiling water and heat to boiling point or until all the soap has dissolved. Add enough of this solution to the washing water to make it froth well. Any kind of soap may be used for washing skins.

When the skin is quite clean, it must be thoroughly rinsed, first in lukewarm and then in cold water. This can easily be done by placing the skin in a small bath and then directing a jet of water over it with a garden hose until all the soap has been removed. Wring out as much of the water as possible. The skin may also be loosely run through a mangle to dry it.

The use of washing soda is not recommended since it tends to loosen the wool from the skin.

Dressing the Skins.

In the subsequent treatment of the skin one of two methods may be followed in order to preserve and " brey " or soften it.

I. THE SULPHURIC ACID METHOD.—Dissolve 4 lb. of coarse salt in 1 gallon of rainwater, which may be heated slightly in order to allow the salt to dissolve more readily.

Pour this salt solution into an earthen bowl or small bath containing 5 gallons of rainwater so that the bath contains altogether 6 gallons of water. Stir until no more undissolved grains of salt remain. Slowly add 1 lb. (i.e. one standard cup) of commercial sulphuric acid (obtainable from any chemist) to the solution. The chemical reaction which follows will cause the water to become warm. Proceed very carefully until all the sulphuric acid has been added, and stir continually with a flat stick or large wooden spoon. This solution is sufficient for treating three skins.

" Breying " or softening the skins.—Place the washed skin in this solution so that it is completely immersed. Leave the skin in the solution for three days, and turn it every day. If the skin is quite white, it may be removed before the third day. Wring out as much of the liquid as possible.

Finishing the skin.—Hang the skin in a cool place; it must not be exposed to the sun. As soon as the skin is wind-dry the suède side must be scraped with a blunt knife to remove the dark deposit which has formed. It is not necessary to " brey " the skin much since the sulphuric acid and salt solution softens it well.

To give the suède side of white skins a good finish, they must be sprinkled with fine starch and then rubbed with emery-paper or a piece of white sandstone. When the skin is quite white, all the excess starch and loose fibres or membranes are brushed off. Dyed skins are rubbed with emery-paper or sandstone without starch. After this treatment the skin is ready for the manufacture of articles. If a coloured skin is desired, the dyeing process can be carried out at this stage.

N.B.—This solution must not be placed in a metal container since the acid will corrode it. Enamel containers will also be damaged. An earthenware or cement basin is most suitable for this purpose. A tin which has previously been well greased on the inside so that the solution does not come into contact with it at any point may also be used.

The pelts of dassies or rock rabbits, jackals and other animals may be prepared in the same way for karosses and other articles.

II. ALUM, SALT AND SALTPETRE METHOD.—This brine mixture is made by dissolving 2 oz. alum, 1 oz. salt and 1 oz. saltpetre in a small quantity of hot water: 1 oz. alum, or 1 oz. salt, or 1 oz. saltpetre, or 1 oz. of carbolic acid is equal to two level tablespoonfuls. Add sufficient cold water to make up 2 gallons. Two ounces of carbolic acid may also be added to disinfect the skin thoroughly. Soak the washed skin in the solution for 26 hours. Remove the skin and rinse it in cold water. If a white skin is required rinse it in blue. Wring out the water thoroughly and hang the skin in a cool place to dry. The suède side must on no account be exposed to the sun since the skin will dry too rapidly and may crack. As soon as the skin is only slightly damp it is " breyed." until soft and dry. The skin may also be left until quite dry, and then dampened again for the dressing and softening process.

" Breying " or Softening of Skins.

Skins may be worked by hand, but this process takes a long time and is very difficult.

The easiest method is to draw it back and forth over a stake which may be made as follows: Straighten the longest leaf of an old motor car spring and sharpen one edge. Plant two posts in the ground, and firmly screw or bolt the motor car spring, sharp edge uppermost, to the tops of the posts. The blade may also be attached to two trees standing close together. The spring should be about 5½ feet from the ground.

Moistening of Skins.—If the skin has become dry, it should be dampened before the " breying " process is started. Moisten an old towel with the above brine solution and spread it out on the suède side of the skin. Fold the skin double with the suède side inward and roll it up. As soon as the skin is damp and elastic, it is ready for " breying " and softening. This is done by pulling the skin back and forth across the blade, with the suède side in direct contact with the knife edge. This work must be done by two or four persons. They must stand on either side of the posts, one (or two) holding the head end and the other one (or two) the hindquarters. The skin is then drawn back and forth across the knife-edge of the spring. After that the skin is stretched crosswise by holding on to the sides and drawing it over the knife-edge. Continue this treatment until the skin is quite soft and dry. Make sure that the edges of the skin are also properly " breyed ".

White skins may be finished with starch and emery-paper as described above.

Dyeing the Skins.

After the skins have been cured and breyed (or partly breyed) in one of the ways described above, they may be dyed. It is essential that the wool should not be greasy, otherwise the dye will not take well.

Sheepskins cannot be dyed at a high temperature because they harden when heated. A temperature which is too high for the human skin will also damage a sheepskin. All dyeing processes are, therefore, carried out at a moderate temperature. Specially selected acid dyes are recommended for this purpose. In order to determine the quantity of dye to be used, the skin must first be weighed after having been cleaned and thoroughly dried.

The Use of Acid Dyes.—Depending on the depth of colour desired, ½ to 2 oz. of dye may be used for every 100 oz. skin weight. Add 10 per cent. Glauber's salt and 2 per cent. formic acid (50 per cent. concentration) to the dye, i.e., use 10 oz. (20 tablespoonfuls) Glauber's salt and 2 oz. (4 tablespoonfuls) formic acid, for every 100 oz. skin weight.

Example : Suppose the weight of the skin is 30 ozs, and the depth of colour 2 per cent.

Quantity of dye required $= \left\{ \frac{2}{100} \times 30 \right\}$ oz. $= (^3/_5 \times 3$ tablespoonfuls.

$= 1^4/_5$ tablespoonfuls.
(because 3 tablespoonfuls of dye = 1 oz.)

Quantity of Glauber's salt required $= \left\{ \frac{10}{100} \times 30 \right\}$ oz. $= (3 \times 2)$ tablespoonfuls.

= 6 tablespoonfuls.
(because 2 tablespoonfuls of Glauber's salt = 1 oz.).

$$\text{Quantity of formic acid required} = \left\{\frac{2}{100} \times 30\right\} \text{oz.} = (3/5 \times 2) \text{ tablespoonfuls.}$$
$$= 1^1/_5 \text{ tablespoonfuls.}$$
(because 2 tablespoonfuls of formic acid = 1 oz.).

N.B.—Ordinary vinegar may be used instead of formic acid. In that case take 15 times the required quantity of formic acid, e.g., 18 tablespoonfuls of vinegar instead of $1^1/_5$ tablespoonfuls formic acid.

Method.—Dissolve the dye in boiling water and add the Glauber's salt. Add sufficient lukewarm water to cover the skin. Heat to 45° C. or 50° C. (as hot as the human hand can bear).

Rinse the skin in lukewarm water, wring out well, place the wet skin in the dye and stir. After 15 minutes add the formic acid or vinegar. Stir from time to time and see that the skin is well covered with the dye solution. Leave the skin in the dye-bath (temperature 45° C. to 50° C.) for 1 hour, or it may even be left in the dye for 2 hours to ensure a better colour.

Rinse the skin thoroughly after the dyeing process, wring out well and hang in the shade to dry. Take the same precautionary measures as for undyed skins, and "brey" in the same way.

It will not be necessary to "brey" the skin for long since it will already have been worked well before the dyeing process.

Manufacture of Sheepskin Articles.

After the different methods of treatment have been completed, dyed or undyed sheepskins are ready for the manufacture of useful articles like slippers, waistcoats, gloves, floor-mats, stuffed toys, furniture polishers, etc.

Very little equipment is necessary for making these articles, the only things required being needles, pins, thread, a pair of pliers, a wire brush, a stick for stuffing, a thimble and a pair of scissors. The paper patterns used for cutting out the articles to be made are placed on the suède side of the skin. Note the direction of the pile of the wool and make sure that the different parts of the pattern are so placed that the pile of the wool lies the same in every case. Trace the outlines of the pattern carefully with a pencil and cut out with a razor blade or sharp pointed knife along the marked lines. Cut only through the skin and not through the wool, otherwise the seams will show when the pieces are stitched together. Brush the wool on the different pieces well by placing a piece of skin near the edge of a table and allowing it to project ¼ of an inch. Allow more of the skin to hang over the edge and brush again until the whole piece has been treated in this way. The wool must be well brushed from the butt or skin end to the tips.

Now lay the woolly sides of two pieces together and carefully press the wool inwards. Sew together by means of overhand stitching, using a double thread.

Toys.—In making toys the easiest method is first to stitch the under-body and the head gussets to the rest of the body and then to sew the two sides of the body together. An opening should be left in an inconspicuous place for stuffing, e.g., under the belly, or on the back in the case of a teddybear, so that the animal can be turned right side out and stuffed when the appendages have been sewn to the body. Turn the article inside out by first pushing in the small appendages like the legs and tail with a little stick. The article can then be stuffed. Use clean, teased wool, kapok, raw cotton or snip-

pets of material for stuffing. Stuff the article with the aid of a small stick; do the head first, taking care to get the right shape, then the legs and smaller parts, and finally the body.

The opening is then sewn up by first catching a stitch on one side and then on the other. Strong thread must be used and a curved needle will facilitate the work.

The shape of the animals should be as natural as possible. Use a live animal or picture as a model. The shape will be improved by putting a few stitches with strong thread right through the animal.

Animals intended to stand must have firm legs. Cylinders of wire or papier maché which can be purchased, are used to make the legs rigid. Another plan is to roll brown paper tightly around a thin stick and then glue it down well.

For wire legs binding wire is used. Cut off a piece sufficiently long for a pair of legs and bend the ends as shown in the illustraion. Bend the wire so that it just fits inside the legs, twist wool, cotton-wool or material around the ends and sew on. (Fig. 1.)

The wire is placed in the front and hind legs and the stuffing placed around the wire to keep it in position.

To give the animals a neat finish, the wool on the face is cut slightly shorter. See that the face has a natural expression. Eyes are obtainable in different sizes from taxidermists at about 1s. a pair.

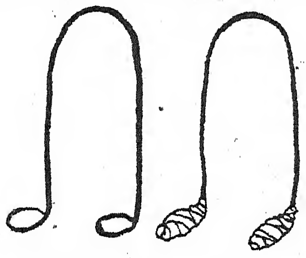

FIG. I.

A small piece of wire is attached to each eye. Cut this back to about half an inch from the eye and bend the end to form a ring. Then attach a double strand of strong thread to the ring with a long needle. Cut slits into the animal's face where the eyes must come and sew the eyes into position as illustrated in Fig. II. The eyes of different animals are sewn in different positions. Hares and rabbits which are preyed upon by other animals have their eyes situated at the side of the head. The needle is passed right through the head from one side to the other in order to fix the eyes. The eyes of domestic animals like cats and dogs look straight ahead and the needle is passed from front to back. After the eyes have been sewn into position, the wool is combed once more to prevent the stitches from showing.

Ears and tails must be sewn on firmly.

Black or brown filosheen is used for making the muzzles and mouths. Light red thread may be used for white rabbits and white kittens.

Toes, claws and hoofs are also embroidered with wool or filosheen. Horsehair can be used for the whiskers of cats and hares. Thread the horsehair through a needle and draw it through the face of the animal so that the required length protrudes. Sew a few stitches, return the needle through the face and cut off the hair to the required length. Repeat the process for the other side of the face.

Brush the wool of the animal well and trim it to the correct length.

The puppy and dog are sewn and stuffed as described above. The ears are sewn on to the seams of the head, as indicated in Fig. III. A leather collar is placed round the puppy's neck.

The wool on the faces of the hare and kitten is trimmed around the muzzle, which is then embroidered. Both are provided with whiskers and bows. The elephant is made of fawn-grey skin and the nails embroidered in grey wool. (Fig. IV.) Pieces of bamboo are

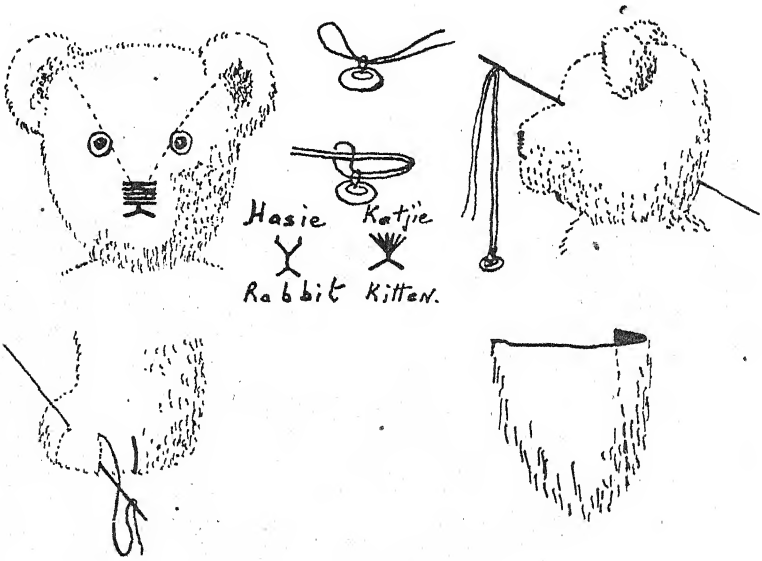

FIG. II.

cut for the tusks and a short cord of grey knitting wool is used for the tail. Put a few stitches in grey wool around the eyes to represent eyelids.

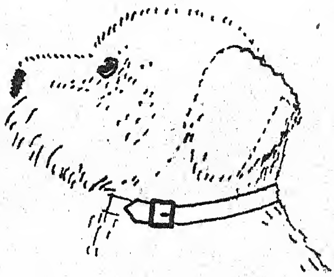

FIG. III.

The limbs of the teddybear can move; this animal is, therefore, made quite differently. The following articles are required in this case:—

5 bolts and nuts about 1 inch long;
5 pairs of thin wooden washers as indicated on the pattern;
a golden brown sheepskin and wool for stuffing;
2 large brown eyes and black darning wool.

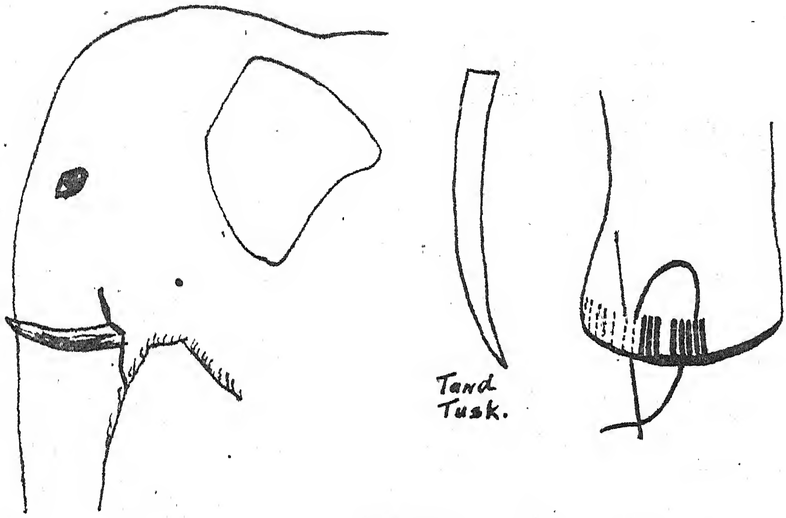

FIG. IV.

Cut out the pieces as described above. Sew the two body pieces together and leave an opening on the back for stuffing. Turn the body inside out. Sew the head gussets first to one side of the head and then to the other. Gather it slightly to get a well-shaped head. Then turn the head right side out and stuff firmly. Put a bolt through a wooden washer—it should fit snugly and not rotate. Place the washer on top of the stuffing inside the neck. Now draw the neck tightly around the bolt and sew up, leaving the bolt protruding. Press the bolt through the upper part of the body just where the seams cross. Press it through another wooden washer and screw the nut down. Rivet the screw-end of the bolt slightly to prevent the nut from working loose.

Sew up the arms and legs, leaving an opening at the tops for stuffing. The soles of the fore and hind legs are made of leather or suède skin. Turn the arms and legs right side out and stuff to near the top. Insert four bolts through four wooden washers and press them through the marked places in the arms and legs, and then through the sides of the body in the right position. Again place a washer on each bolt inside the body, screw down the nuts and rivet the ends of the bolts slightly, as before. Complete the stuffing of the arms and legs, and sew up the openings.

Stuff the body and sew up the opening. Gather the ears slightly and sew them in the position indicated on the pattern. The ears are sewn on in a curve and extend halfway over the head gusset.

Brush the seams well and trim the wool on the face. Sew the eyes in position, embroider the muzzle and mouth, and mark the claws. (Fig. II.)

Patterns and instructions for making ducks, penguins, lambs and spaniels may be found in books on this subject.

Sheepskin slippers are comfortable and warm in winter. The suède side of the skin comes on the outside, and should, therefore, be dyed uniformly and have a smooth velvety surface. To obtain such a surface the skin must be " breyed " while still white until it has a a suède-like finish. Now weigh the skin, rinse in it lukewarm water and dye according to the instructions given above. Allow the skin to

dry, then dampen it slightly and carefully soften it without scraping off to much of the suède. For this second "breying"-process the blade may be fairly blunt.

Now lay the pattern on the suède side, draw the outline with a pencil, and cut out with a razor blade. Brush the wool well. Sew on the wool side, using overhand stitching, with a silk thread to match the colour. Turn the slipper inside out, fold over ½ inch of the upper edge and sew the fold down at the back seam. The wool will form an attractive decoration around the edge.

Brush the suède with a suède shoe-brush.

Floor-mats.—Attractive and serviceable mats may also be made from skeepskin. Designs cannot, however, be stencilled on them. Separate pieces of differently coloured skin are "breyed", and then sewn together. A pleasing mat can be made, for example, by dyeing one skin a fawn colour, another brown and a third old-gold or any other colour which matches. After the fawn-coloured skin has been "breyed" it is cut into an oblong or oval shape. An edging three to four inches wide is cut from the brown skin. Carefully brush the various pieces. Lay the fawn skin on the table, suède side upwards, and place the brown edging around it—also suède side upwards. Now sew the edging to the mat, first catching a stitch on the edge and then on the mat, with a strong wax thread. Make sure that the skin does not pucker.

Draw a simple design in the middle of the fawn-coloured piece, on the suède side and cut it out carefully with a razor blade. Draw the same design on the old-gold coloured skin, cut out carefully and brush well. Now lay the old-gold piece in position in the middle of the fawn-coloured skin. Press the wool down out of the way and sew the pieces together as previously described.

Brush the mat again so that the seams do not show. Trim the wool to a uniform length if necessary. Sew a piece of stiff lining to the back. Well starched hessian is quite suitable for this purpose. The design given below is also very easy to carry out. (Fig. V.)

Floor mats form part of the background of a room. Gaudy colours should, therefore, not be used. Natural animal and flower designs are also not suitable for mats.

Furniture polishers can be made from all the remnants of skin. Saw a block of wood 2½ in. by 1½ in. by 5 in. and nail a piece of skin 3½ in. by 5 in. over the bottom.

(*N.B.*—The addresses of firms which stock acid dyes are obtainable from the Department of Agriculture and Forestry.)

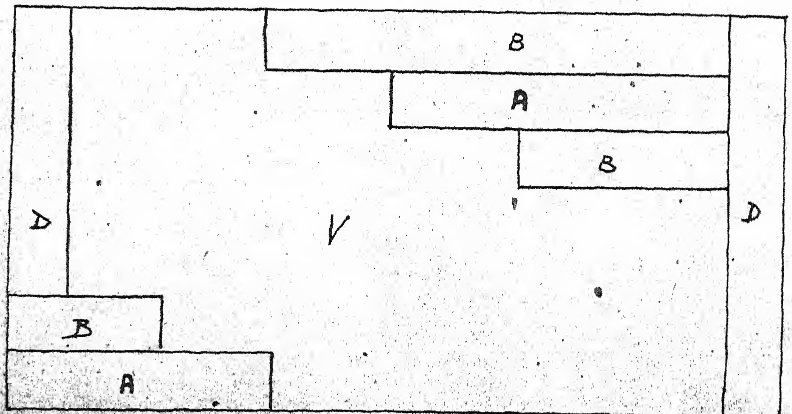

FIG. V.

Nutritive Value of Green Peas.

Miss E. Teichmann, Home Economics Officer, Pretoria.

GREEN peas are one of the most delicious of all summer vegetables. They are easy to grow and easy to cook, and their high food value, their colour so pleasing to the eye, and taste so acceptable to the palate, place the pea amongst our most important vegetables in the daily diet.

They are classed under the legumes, the name applied to seeds, which belong to the leguminosae or pulse family. The legumes are known for their high protein content and hence the pea is considered a very rich source of this foodstuff so essential for building up and repairing the body tissues.

High Food Value.

Apart from proteins, we also have the minerals: phosphorus, iron, copper, manganese and significant, though relatively less abundant, amounts of calcium present in the pea. The salts of all these minerals enter into the structure of the skeleton and the soft tissues and take a prominent part in the maintenance of life and health through the regulation of body processes.

Vitamins, so essential to the body for the maintenance of health and resistance to disease are also present. Fresh green peas are especially rich in Vitamin A or more commonly known as the eye protecting vitamin, and Vitamin C or the anti-scorbutic vitamin. The energy supplying foodstuff in peas is sugar which is deposited as the insoluble carbohydrate, starch, in the mature seed. Immature peas deteriorate rapidly in sugar content after they are gathered. Losses in sugar content can be prevented by shelling, blanching, cooking or storing near freezing temperatures.

Peas can be prepared in various ways to make a most palatable dish, served either at luncheon, supper or dinner.

It is most important that peas be cooked quickly in just enough water to prevent burning. The longer the pea is exposed to heat the greater will be the destruction of protective substances. Have the water in which they are to be boiled ready, i.e., at boiling point with a little salt added. Then put in the peas and boil rapidly until they are soft. By this time most if not all, of the water must be evaporated. Serving the peas merely boiled up in salt water is not so attractive. A little sugar, just enough to emphasize the sweetness of the peas, and a little butter improve the flavour, and also increases the nutritive value of the dish. The addition of a little chopped mint while the peas are boiling gives additional flavour.

In Salad.

Cold cooked peas are a valuable ingredient in a salad. The bright green colour and delightful flavour blend very well with fruit and vegetables such as apples, pineapples, potatoes and carrots. On a hot summer day when crisp cold salads are in great demand, a fruit and vegetable salad is always welcome. Combine cooked green peas with cubed pineapple and cooked cubed carrots and potatoes, and arrange this salad on crisp shredded lettuce or individual portions on lettuce leaves and serve it with a mayonnaise or boiled dressing.

Remember the keynotes of a salad are coldness and crispness; so do not forget them in preparing this salad.

Another variation is to serve the peas with a white sauce, made in the following way: Melt 2 tablespoons of butter and add 2 tablespoons of flour. Mix thoroughly. Then add 1 cup of milk gradually while stirring constantly. Boil for a few minutes. Season with salt and pepper. Then when the peas are ready pour the white sauce over them, sprinkle a little chopped parsley over, and serve hot.

Soup.

A most nourishing soup can be made with cooked peas and the white sauce previously discussed. Use the same amounts of butter and flour, that is, 2 tablespoonfuls of each, but increase the amount of milk to 2 cups. When the white sauce is ready, rub 1 cup of cooked peas through a sieve and add to the white sauce, season with salt and pepper. If the soup is too thick to your liking, add a little extra milk. A little chopped parsley sprinkled over the top improves the appearance and taste as well as the nutritive value.

A Soufflé.

For a little variation we can have something quite different: a soufflé, light and tasty, also made with green peas. For this use 1⅓ cups of cooked peas rubbed through a sieve. Add a cup each of cheese, breadcrumbs, milk and salt and pepper to season. Separate one egg, beat the yolk slightly and the white until quite firm. First add the yolk and then fold in the white. Bake the mixture in a greased baking dish at a temperature of 350° F. for half an hour or until it is set.

This dish must be served immediately because the soufflé falls as it cools off and this not only spoils the appearance but affects the lightness.

In future, when peas are in season, make the fullest use of them. Serve them not only as plain buttered boiled peas, because it is easy and quick, but take a little extra trouble and serve them in as many different ways as you can think of.

Brine in Refrigerating Systems.

IN view of the critical position in regard to Sodium and Calcium brines, and also in view of the need for reducing corrosion in refrigerating plants to a minimum, the Officer-in-Charge of Dehydration and Cold Storage, P.O. Box 3, Cape Town, has drawn up notes on the uses of brine in refrigerating plants, and methods of testing such brines.

Readers who are interested in the subject can apply to the above address for copies of the notes and also obtain particulars about advice and assistance on any problem connected with the use of brines.

" Foods and Cookery ", Bulletin No. 115, *is out of print.*

Bulletin No. 237, *" Eggs and Poultry in Cookery ", which contains many useful recipes, is obtainable at* 6*d. per copy from the Editor.*

Crops and Markets

A Statistical and Economic Review of South African Agriculture

by

The Division of Economics and Markets

Vol. 22 NOVEMBER 1943 No. 255

CONTENTS

* Price Review for October, 1943.

SLAUGHTER STOCK.—Reasonable numbers of cattle came on the market but consisted largely of inferior qualities. Prime cattle was scarce. During the first half of the month, prices advanced to quite an extent, but a decline again set in during the second half. For the better classes the average prices of the month were again well above that of the previous month. On the Johannesburg market ordinary primes were 81s. 11d. per 100 lb. estimated dressed weight *on the hoof*, as against 76s. 11d. for September, and good mediums were 77s. 10d. as against 72s. 10d. per 100 lb. for the previous month For inferior qualities the average price-level remained more or less unchanged.

Larger numbers of slaughter sheep, including a good percentage primes, came on the markets and prices in general declined. On the Johannesburg market merinos declined from 12·8d. per lb., estimated dressed weight to 11·5d. for October and prime crossbreds from 12·0d. to 10·1d. On the Cape Town market the drop in the case of prime merinos were from 12·0d. to 11·3d. per lb. for October and for prime crossbreds from 12·0d. to 11·2d. per lb.

Grain and Hay.—Supplies of kaffircorn and dry beans increased to quite an extent during the month, and although prices of kaffircorn as a result declined somewhat, that of dry beans differed little or nothing from the previous month's level.

Larger consignments of all the more important kinds of hay, like lucerne, oats and teff, arrived. Offerings of Cape lucerne especially increased appreciably and prices as a result dropped to quite an extent, e.g., on the Johannesburg market from 7s. 4d. per 100 lb. to 6s. 2d. for October.

* All prices mentioned are average.

Potatoes.—Supplies of Transvaal potatoes on the markets were lighter excepting National Mark potatoes, which were reasonably plentiful on the Johannesburg market. Prices of the latter, therefore, declined somewhat, viz., N.M. Grade 1, No. 2 and 3, from 19s. 3d. and 19s. 10d. per bag in September, to 18s. 10d. and 18s. 1d. per bag respectively for October. Locally produced fresh potatoes of good quality were present on most markets and prices of these in general advanced, e.g., on the Cape Town market, Cape No. 1 rose from 20s. per bag to 21s. 3d. for October and on the Durban market, Natal No. 1 rose from 17s. 11d. to 18s. 10d. per bag.

Onions.—Appreciably large offerings of Transvaal onions were present on the markets and little Cape onions. Prices of the latter, therefore, declined fairly sharply, viz., on the Johannesburg market from 26s. 6d. to 19s. 4d. per bag for October, while prices of Cape onions also experienced a slight decline.

Tomatoes.—Consignments were mostly from the Transvaal Lowveld and were scarce and in some cases of poor quality. The demand, however, was exceptionally sharp and the levels of the previous month were in general maintained. National Mark No. 1 on the Johannesburg market averaged 8s. 3d. per tray for October and ordinary tomatoes 4s. 2d. per tray. On the Cape Town market the average price for the month was 4s. 4d. and on the Durban market 2s. 3d. per tray.

Vegetables.—Supplies of most kinds of vegetables were relatively large and prices on the whole dropped and in some cases exceptionally sharply, especially that of green beans, green peas and vegetable marrows. Fairly large supplies of vegetables from the Transvaal Lowveld were on the Johannesburg market.

Fruit.—Valencia oranges were still the most important fruit on all markets, although supplies were more moderate than the previous month. The demand was stable. Other fruits were scarce. Apples were practically the only deciduous fruit of importance. With regard to tropical fruit, pawpaws were fairly plentiful and prices declined. Offerings of pineapples and granadillas also increased.

Eggs.—Supplies were more or less the same as for the previous month, but prices dropped slightly. On the Johannesburg market new laid eggs were 1s. 5d. per dozen and fresh eggs 1s. 2d. per dozen.

Index of Prices of Field Crops and Animal Products.

This index, which appears elsewhere in this issue, has now been revised and slight amendments have been effected in some of the groups. Straight annual averages have been substituted by weighted annual averages, where these are now available.

According to this index the following groups declined during October as compared with September:—

(i) Hay, viz., from 156 to 161, mainly as a result of a decrease in prices of lucerne hay.

(ii) Slaughter stock from 201 to 198 due to the drop especially in prices of slaughter sheep.

(iii) Poultry and poultry products from 180 to 169 for October. Prices of eggs indicate a decline compared with the previous month, although prices of poultry advanced slightly.

The only group indicating an increase, is that of "Other Field Crops" (potatoes, sweet potatoes, onions and dry beans), viz., from 184 to 189 due to an increase in the prices of potatoes. Onions on the other hand dropped in price.

The combined index was 157 as against 158 the previous month.

The index for prices for certain farming requisites will appear in the January issue.

Wheat Prices for the Crop Year 1943-44.

AS a result of a further increase in the cost of production of wheat and the lower yields expected on account of an inadequate supply of fertilizer, the Government had already announced in March of this year that producers will receive 36s. per bag for class B, grade 1 wheat the coming season. The Wheat Industry Control Board has, therefore, fixed prices for the 1943-44 crop accordingly.

The maximum price of standard bread for a two-pound loaf has been fixed at 6½d. retail delivered. In order to enable bakers to sell bread at this price, the Government, in conjunction with the Board, has undertaken to pay to the producer a subsidy in addition to the fixed basic price, so that the latter's total receipts may, e.g., in the case of grade 1, class B wheat, amount to 36s. per bag.

The following are the fixed basic prices of wheat in bags for the coming season.

Grade.	*Class A.*		*Class B.*		*Class D.*	
	s.	d.	s.	d.	s.	d.
1	29	0	28	6	25	6
2	28	8	28	2	25	2
3	27	9	27	3	24	3
4	—		25	8	22	8
5	—		23	9	20	9
6	—		21	7	18	7

These prices are free-on-rail producer's station and subject to an agent's commission of 9d. per bag in each case. In addition to these prices, producers will also receive the following amounts per bag:—

Grade.	*Class A.*		*Class B.*		*Class D.*	
	s.	d.	s.	d.	s.	d.
1	7	6	7	6	7	6
2	7	4	7	4	7	4
3	7	0	7	0	7	0
4	—		6	4	6	4
5	—		5	7	5	7
6	—		4	9	4	9

The total amount which a producer will now receive in the case of a bag of Grade 1, class B wheat is 28s. 6d. plus 7s. 6d., i.e., 36s. per bag as against 30s. per bag for the corresponding grade and class the previous season (less 9d. agents' commission in each case).

All wholesale and retail prices of bran and other wheat products have also again been fixed for the coming season. For full particulars in this connection see the *Government Gazette Extraordinary* of 30th October, 1943.

Prices of Rye, Oats and Barley, 1943-44 Season.

ON instruction of the Controller of Food supplies, the crops of the above-mentioned cereals will again be controlled by the Wheat Industry Control Board. Producers may, therefore, sell their rye, oats and barley only to the Board. As was the case the previous season, rye and rye products will again be controlled in the same manner as wheat and wheaten products, while in the case of oats and barley control measures will only be applied to the grain.

The Board will buy rye, barley and oats at the following fixed prices:—

RYE.

	s.	d.
Grade 1	23	6
Grade 2	23	0
Grade 3	21	6

BARLEY.

Grade.	*Class A.*		*Class B.*		*Class C.*		*Class D.*	
1	21	0	20	0	15	6	22	6
2	19	6	18	6	15	0	21	6
3	18	6	18	0	14	0	20	0

OATS.

Grade.	*Class A.*		*Class B.*	
	s.	d.	s.	d.
1	16	0	15	6
2	15	6	15	0
3	—		14	0

Prices of rye and Class D barley are per bag of 200 lb. and of oats and class A, B and C barley are per bag of 150 lb. All prices are free-on-rail producers' station.

Furthermore, the prices at which the Board will again sell these cereals have also been fixed, as well as all wholesale and retail prices of rye products.

For full particulars in this connection see the *Government Gazette Extraordinary* of 15 October 1943.

Prices of Dairy Products.

PRICES of butterfat delivered to creameries by producers have been fixed by the Dairy Industry Control Board at 1s. 7d., 1s. 5d. and 1s. 3d. per pound for 1st, 2nd and 3rd grade respectively, as from 1st November, 1943. This is 1d. per pound more for each grade than the corresponding prices paid to producers the previous summer, viz., from 1 November 1942. The winter premium (subsidy) of 6d. per pound on butterfat which was paid as from 1 August 1943, will also cease to be paid from 1 November 1943.

The price of milk for condensing purposes paid to producers has been fixed at 10d. per gallon or 2s. 4d. per pound butterfat contained therein as from 1 November 1943. These are the same as the prices fixed for the previous summer.

The winter premium (subsidy) of 2d. per gallon on cheese milk paid from 1 May 1943, will also cease to be paid from 1 November 1943. The price which producers will receive for cheese milk remains unchanged, viz., 9d. per gallon or 2s. 1d. per pound butterfat contained therein.

Index of Prices of Field Crops and Animal Products.

(Basic period 1936-37 to 1938-39=100.)

SEASON. 1st July to 30th June.	Summer Cereals. (a)	Winter Cereals. (b)	Hay. (c)	Other Field Crops. (d)	Pastoral Products (e)	Dairy Products (f)	Slaughter Stock. (g)	Poultry and Poultry Products. (h)	Combined Index.
WEIGHTS.	19	13	2	3	34	6	17	6	100
1938-39	92	107	96	89	79	102	106	92	93
1939-40	86	107	77	95	115	105	106	89	103
1940-41	109	113	106	156	102	108	110	104	108
1941-42	121	134	143	203	102	131	134	145	123
1942-43	160	149	144	159	122	147	167	173	146
1942—									
July	159	143	187	184	122	166	154	173	146
August	159	143	185	175	121	166	155	137	143
September	159	142	186	191	121	166	175	141	147
October	160	143	160	233	121	166	182	149	150
November	160	152	137	192	121	138	187	155	149
December	100	152	126	141	121	138	178	168	147
1943—									
Januarie	160	152	135	116	121	138	165	159	143
February	163	152	133	117	122	138	156	198	145
March	161	152	145	120	122	138	159	230	147
April	159	152	145	143	122	138	163	279	151
May	169	152	147	158	122	162	165	337	159
June	169	152	169	166	122	162	166	214	152
July	170	152	178	187	122	175	182	195	156
August	170	152	179	181	122	181	184	182	156
September	169	152	186	184	122	181	201	180	158
October	169	152	161	189	122	181	198	169	157

(a) Maize and kaffircorn.
(b) Wheat, oats and rye.
(c) Lucerne and teff hay.
(d) Potatoes, Sweet potatoes, onions and dried beans.
(e) Wool, mohair, hides and skins.
(f) Butterfat, cheese milk and condensing milk.
(g) Cattle, sheep and pigs.
(h) Fowls', turkeys and eggs.

Average Prices of Potatoes and Onions on Municipal Markets.

SEASON (1st July to 30th June)	POTATOES (150 lb.).						ONIONS (120 lb.).		
	Johannesburg.				Cape Town.	Durban.	Johannesburg.	Johannesburg.	Cape Town.
	Transvaal. No. 1.	Transvaal. No. 2.	N.M. Grade 1. No. 2.	N.M. Grade 1. No. 3.	Cape No. 1.	Natal No. 1.	Transvaal.	Cape.	Cape.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	6 9	6 2	8 10	8 1	8 3	8 10	8 3	8 10	7 4
1940-41	14 2	13 4	18 6	18 5	15 7	16 10	12 5	12 3	9 10
1941-42	19 3	18 7	24 9	25 4	20 1	23 3	10 5	13 11	10 4
1942-43	13 7	12 6	15 8	15 11	15 0	16 9	13 8	14 0	12 6
1942—									
January	18 8	16 4	20 6	18 11	15 3	23 2	9 3	10 2	7 10
February	15 9	13 11	20 11	20 5	16 3	20 3	9 10	9 9	7 0
March	16 6	15 2	21 4	21 7	18 4	21 3	8 9	9 5	6 7
April	14 6	13 4	21 1	21 2	19 9	18 2	11 9	12 10	7 6
May	15 11	16 1	21 7	21 11	20 2	18 7	11 9	12 10	10 10
June	17 10	17 6	22 3	22 10	17 10	20 4	14 0	14 6	11 7
July	17 0	17 1	21 0	22 3	19 6	19 6	13 7	14 10	12 10
August	14 7	14 10	21 4	22 6	18 4	20 8	1[illegible] 2	15 4	12 11
September	15 1	16 9	23 5	23 9	20 0	20 5	21 2	20 7	18 10
October	21 3	19 0	24 6	24 4	22 10	24 11	17 10	20 0	25 11
November	16 1	15 11	18 3	18 8	18 10	21 4	11 11	—	17 10
December	11 6	9 6	14 1	13 3	12 2	15 6	9 3	10 11	11 9
1943—									
January	7 9	6 8	10 9	10 8	10 9	14 2	8 5	9 4	7 8
February	8 3	7 2	11 8	11 6	8 4	13 7	7 10	10 9	7 8
March	8 10	8 5	13 1	12 7	8 4	13 9	8 1	11 0	7 3
April	11 5	11 1	15 8	15 0	13 0	14 7	11 6	12 10	9 10
May	12 6	12 2	15 11	15 5	15 6	16 3	16 4	15 8	13 2
June	12 11	14 1	19 9	19 0	14 6	17 9	17 3	17 4	14 3
July	16 4	15 11	21 5	21 4	18 1	18 10	17 9	20 2	16 5
August	13 5	12 5	21 3	21 7	19 0	16 3	17 8	23 3	21 4
September	10 5	11 3	19 3	19 10	20 0	17 11	26 6	26 8	24 9
October	10 10	10 11	18 10	18 1	21 3	18 10	19 4	24 10	24 5

Average Prices of Slaughter Cattle and Pigs.

SEASON (1st June to 31st May).	BEEF PER 100 LB.						PIGS PER LB. LIVE WEIGHT.		
	(a) Johannesburg.				(b) Durban.		Johannesburg.		
	N.M. Prime.	Ordinary Prime.	Good Medium.	Compounds.	Medium.	Compound.	Porkers, Prime.	Baconers, Prime.	Stores.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	d.	d.	d.
1938-39.........	41 9	39 0	36 3	31 7	33 0	27 4	5·3	6·2	4·9
1940-41.........	43 11	41 4	37 11	32 5	31 1	25 4	4·5	5·4	4·0
1941-42.........	55 5	52 0	47 4	38 4	40 3	30 9	5·1	6·6	4·5
1942-43.........	67 4	63 2	57 9	46 1	45 6	35 9	7·2	8·6	6·9
1942—									
January.......	62 3	59 6	54 1	43 5	45 1	29 3	5·6	7·0	5·6
February......	58 3	53 4	49 2	40 6	38 11	26 7	5·4	8·0	5·2
March.........	53 5	47 10	44 3	36 11	37 8	27 11	5·5	8·2	4·8
April..........	53 0	49 10	44 4	35 6	37 3	28 5	5·5	8·2	4·7
May...........	54 4	51 3	47 5	36 8	35 11	26 0	5·0	7·8	4·6
June..........	56 6	53 8	49 8	39 5	37 1	28 6	5·5	8·0	5·1
July...........	61 0	57 8	53 6	44 3	46 10	33 10	6·4	8·4	6·1
August........	62 5	59 2	53 2	43 2	45 3	31 9	6·6	8·6	6·0
September.....	69 9	65 4	60 3	49 2	53 8	41 3	6·8	8·5	6·4
October........	75 1	71 3	65 6	51 2	50 2	39 10	7·7	8·3	7·5
November.....	83 8	78 2	69 0	52 2	47 6(c)	38 7(c)	8·3	8·6	8·2
December......	74 3	69 4	64 3	51 1	51 11	35 11	8·3	8·5	7·9
1943—									
January.......	67 5	62 10	57 2	47 10	45 6	37 0	7·8	8·4	8·4
February......	64 1	60 11	55 8	44 5	43 11	34 6	7·4	8·8	8·0
March.........	63 8	59 2	54 4	43 4	41 0	34 1	6·8	8·8	6·2
April..........	65 6	60 8	55 8	43 4	42 1	33 11	6·9	9·1	6·5
May...........	65 0	59 11	55 3	43 9	42 6	37 6	7·6	8·7	6·6
June.......(d)	36 3	32 7	29 7	23 1	42 6	37 0	8·3	8·7	7·4
		No. 1.	No. 2.	No. 4.					
July........(d)	40 9	37 5	34 6	27 6	45 6	41 0	8·4	8·6	7·1
August........	75 8	70 8	65 3	56 0	49 0	44 0	8·4	8·7	7·2
September.....	81 6	76 11	72 10	65 8	49 0	44 0	7·7	8·9	7·4
October........	88 0	81 11	77 10	65 8	49 0	44 0	7·7	8·8	7·8

(a) Estimated dressed weight of cattle as sold on the hoof. As reported by Meat Control Board.
(b) Dressed weight of carcase sold on the hook.
(c) Grade 3 and undergrade respectively according to new price reporting basis of Durban meat prices since November, 1942. With the new basis Grade 1 corresponds approximately with ordinary primes; grade 2 with good mediums; grade 3 with mediums and undergrade with compounds and inferiors.
(d) For June and July, 1943, prices were quoted per 100 lb. live weight.

Average Prices of Sheep per lb. Estimated Dressed Weight.*

SEASON (1st June to 31st May).	JOHANNESBURG.				CAPE TOWN.			
	Merino Wethers.		Persians and Cross Breds.		Merinos.		Capes and Persians.	
	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.	Prime.	Medium.
	d.	d.	d.	d.	d.	d.	d.	d.
1938-39.........	6·3	5·5	5·8	5·1	5·8	5·6	5·9	5·7
1940-41.........	6·7	6·1	6·2	5·7	6·1	5·8	6·3	6·0
1941-42.........	8·3	7·4	7·5	6·8	7·7	7·2	7·6	7·3
1942-43.........	11·5	9·8	9·8	8·3	10·7	9·8	10·5	9·6
1942—								
January.......	8·7	7·8	7·5	6·7	7·4	7·1	7·4	7·2
February......	9·3	8·3	8·2	7·7	9·0	8·3	8·7	8·3
March.........	9·6	814	8·8	7·9	9·6	8·8	9·3	8·8
April..........	8·8	7·7	7·9	6·9	9·7	8·8	9·4	8·8
May...........	9·1	7·9	8·1	6·9	9·0	8·3	9·0	8·4
June..........	9·7	8·2	8·6	7·3	9·4	8·8	9·6	8·7
July...........	10·3	8·9	9·4	8·0	9·9	9·2	9·9	9·2
August........	11·1	9·3	10·0	8·5	10·6	9·7	10·3	9·5
September.....	12·1	10·5	10·9	9·2	10·1	9·6	10·4	9·4
October........	12·4	10·7	11·4	10·1	10·7	9·3	10·3	9·4
November.....	12·9	11·0	11·6	9·7	10·5	9·9	10·4	9·6
December......	12·3	10·2	10·3	8·7	10·9	10·2	10·8	10·0
1943—								
January.......	11·2	9·4	9·5	8·3	10·8	9·5	10·4	9·4
February......	10·5	8·6	8·2	6·5	10·1	9·3	10·1	9·1
March.........	11·5	9·8	9·0	7·3	11·7	10·6	11·1	10·2
April..........	12·0	10·2	9·5	7·7	12·4	10·9	11·6	10·8
May...........	12·0	10·3	9·6†	7·9†	11·1	10·1	11·1	10·3
June..........	11·4	10·2	10·4	9·2	10·8	10·5	11·0	10·2
July...........	11·4	10·3	10·3	9·3	11·4	10·2	11·2	9·9
August........	11·8	10·2	10·8	9·3	12·4	11·6	12·2	11·1
September.....	12·8	10·9	12·0	9·7	12·0	11·2	12·0	10·9
October........	11·5	9·6	10·1	8·0	11·3	10·5	11·2	10·3

* As sold on the hoof. Reported by Meat Control Board.
† As from June "other hamels".

Average Prices of Eggs on Municipal Markets and Prices of Hides and Skins.

Season (1st July to 30th June).	Eggs.				Hides (per lb.).		Skins.		
	Johannesburg.		Cape Town, per 100.	Durban New Laid, per dozen.	Port Elizabeth.		Port Elizabeth.		
							Merino.		Glovers, Sound, per skin.
	New Laid, per dozen.	Fresh, per sozen.			1st Grade, Sun-dried.	1st Grade, Dry Salted.	Medium, per lb.	Combings, per lb.	
	s. d.	s. d.	s. d.	s. d.	d.	d.	d.	d.	s. d.
1938-39	1 0	0 9	7 11	1 1	6·0	5·3	4·1	5·7	2 9
1940-41	1 1	0 10	8 3	1 3	5·8	6·0	4·9	7·6	2 10
1941-42	1 6	1 4	10 7	1 9	7·2	7·3	5·1	8·6	4 0
1942-43	1 10	1 6	13 5	2 0	7·8	8·2	5·7	9·5	3 5
1942—									
January	1 7	1 4	12 2	2 0	7·5	7·6	4·3	7·9	4 0
February	1 9	1 6	13 1	2 0	7·7	7·8	5·7	8·5	3 0
March	2 0	1 9	14 5	2 6	7·6	7·6	6·4	9·2	3 11
April	2 3	1 9	17 1	2 10	7·5	7·5	7·0	10·5	3 11
May	2 6	2 2	18 11	2 10	7·5	7·6	6·7	9·9	4 1
June	2 6	2 3	22 7	2 10	7·6	7·7	6·0	9·7	4 2
July	1 8	1 6	15 1	2 0	7·8	7·9	6·1	9·4	4 0
August	1 2	1 1	10 11	1 2	7·5	7·8	5·6	8·0	3 2
September	1 2	1 1	10 4	1 4	7·5	7·8	4·8	7·8	3 2
October	1 4	1 2	11 2	1 5	7·6	7·8	5·2	8·5	3 3
November	1 5	1 3	12 2	1 7	7·8	8·1	5·4	9·3	3 1
December	1 8	1 5	13 1	2 0	7·9	8·1	5·5	9·7	3 4
1943—									
January	1 8	1 4	13 11	2 2	8·0	8·1	5·7	9·1	3 4
February	2 3	1 11	16 7	2 7	8·1	8·1	6·1	10·5	3 5
March	2 9	2 3	19 4	3 2	7·8	7·9	5·9	10·8	3 4
April	3 3	2 9	24 8	3 11	7·8	8·7	6·3	11·1	3 7
May	3 10	3 5	29 2	4 10	7·8	8·9	5·9	10·2	3 7
June	2 3	1 10	18 7	2 9	7·9	9·2	5·7	9·9	4 0
July	1 9	1 6	16 3	2 0	8·0	9·3	5·9	9·9	4 5
August	1 8	1 5	13 5	1 9	8·0	9·3	5·8	9·3	4 5
September	1 7	1 5	11 8	1 9	8·0	9·3	5·7	8·7	4 7
October	1 5	1 2	11 7	1 8	8·0	9·3	5·1	8·3	4 7

Average Prices of Green Beans, Green Peas and Carrots on Municipal Markets.

Season (1st July to 30th June).	Green Beans (Pocket 20 lb.).			Green Peas (Pocket 20 lb.).			Carrots (Bag). (a)		
	Johannesburg.	Cape Town.	Durban.	Johannesburg.	Cape Town.	Durban.	Johannesburg.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 8	2 3	2 0	2 4	1 9	1 2	3 8	2 6	6 1
1940-41	1 11	2 9	1 5	2 8	2 4	2 3	5 9	4 11	13 4
1941-42	2 7	3 10	2 6	3 11	3 3	3 4	8 5	8 10	17 2
1942-43	3 1	4 3	3 0	3 3	2 10	3 9	5 1	8 9	13 2
1942—									
January	2 4	0 8	3 1	6 4	—	4 8	5 9	7 8	11 6
February	2 1	1 4	1 7	2 6	—	2 7	10 0	11 6	19 1
March	1 10	2 1	2 2	3 2	2 0	3 6	12 11	10 6	24 7
April	1 6	3 0	1 5	3 3	5 0	2 10	13 5	9 7	29 7
May	2 6	3 3	1 10	4 9	3 8	2 9	9 2	9 8	19 10
June	3 7	2 10	2 4	4 6	5 11	2 10	5 5	11 0	13 2
July	3 5	3 8	4 0	2 6	3 3	2 5	5 7	12 5	11 10
August	3 4	3 10	2 5	2 1	2 7	1 7	4 7	13 4	11 0
September	3 3	4 9	3 2	1 11	3 0	2 3	2 8	10 0	8 3
October	3 0	5 10	1 10	2 4	2 7	2 11	2 11	7 3	4 5
November	2 2	3 2	1 7	2 2	2 0	2 5	3 10	6 7	6 1
December	2 3	2 8	3 3	2 7	4 9	5 3	3 4	6 8	6 10
1943—									
January	1 9	3 3	3 5	2 4	6 9	4 7	3 9	5 1	11 3
February	2 5	4 4	3 10	4 8	5 9	5 1	6 0	6 5	11 4
March	2 8	3 1	1 6	6 7	4 5	3 10	7 9	4 0	19 1
April	2 0	2 2	2 3	5 1	3 0	2 8	8 1	6 10	23 11
May	2 11	4 11	2 11	5 11	4 8	5 2	8 5	11 1	16 10
June	6 5	4 0	4 7	6 5	5 1	9 3	9 1	13 4	18 7
July	9 0	10 1	7 2	4 6	5 9	5 10	11 9	16 1	17 10
August	5 2	6 11	6 11	4 10	5 4	4 7	13 3	14 6	21 0
September	5 3	7 7	4 11	4 7	5 2	3 4	10 10	13 4	21 2
October	1 11	4 4	1 10	1 10	1 11	2 3	8 5	10 11	12 3

(a) Weights of bags vary, but on the average are approximately as follows:—Johannesburg, 130 lb.; Cape Town, 90 lb.; and Durban, 120 lb.

Average Prices of Cabbages, Cauliflower and Tomatoes on Municipal Markets.

SEASON (1st July to 30th June).	CABAGES (Bag). (a)			CAULIFLOWER (Bag). (a)			TOMATOES (Trays 15 lb.).			
							Johannesburg.			
	Johan-nesburg.	Cape Town.	Durban.	Johan-nesburg.	Cape Town.	Durban.	N.M. No. 1.	Other.	Cape Town.	Durban.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	3 10	3 0	3 10	3 0	1 8	3 5	2 2	1 3	1 8	0 10
1940-41	5 10	4 8	7 1	3 11	4 3	5 3	2 7	1 6	2 1	1 2
1941-42	8 10	5 5	11 5	5 9	5 7	7 11	3 1	1 9	2 3	1 6
1942-43	5 6	5 11	9 1	5 0	5 9	7 6	3 4	1 10	2 1	2 7
1942—										
January	7 7	5 4	9 1	8 1	4 0	—	2 11	1 0	1 6	2 1
February	8 0	6 3	18 3	5 10	—	—	3 6	1 7	1 5	1 5
March	7 3	6 0	22 9	5 6	8 0	—	5 8	2 7	1 3	2 6
April	8 2	4 9	16 3	6 4	5 8	12 6	5 4	2 6	1 8	1 11
May	7 7	3 9	10 0	6 2	5 0	11 5	3 11	2 4	2 10	1 7
June	6 11	3 2	7 10	6 10	5 2	7 11	2 8	1 5	2 5	1 4
July	7 7	4 5	6 11	6 3	5 2	6 2	2 3	1 3	1 11	1 1
August	6 0	4 7	3 11	3 8	5 11	5 1	2 5	1 3	1 7	0 7
September	5 9	4 11	2 9	3 11	6 4	6 7	2 5	1 3	1 9	0 9
October	4 2	6 10	2 5	—	4 9	5 5	2 6	1 5	2 0	1 4
November	3 3	6 7	2 4	—	7 4	11 0	3 6	2 0	2 8	1 10
December	3 11	7 10	3 2	—	4 0	—	3 8	1 10	3 0	2 4
1943—										
January	5 1	9 0	12 6	—	—	—	4 11	2 4	2 6	2 8
February	6 4	10 2	15 2	5 7	5 8	—	5 5	2 7	1 8	2 11
March	5 6	9 6	8 6	6 6	5 11	—	3 11	1 9	1 10	2 7
April	4 1	9 5	8 1	3 2	6 1	7 4	3 4	1 7	2 2	3 1
May	4 5	6 0	7 9	3 10	5 0	7 0	4 10	2 6	2 3	2 6
June	7 6	5 5	12 8	8 7	6 1	11 11	7 2	3 8	4 0	3 6
July	10 4	6 7	11 1	8 5	5 3	11 0	7 11	4 5	3 10	2 1
August	12 4	6 8	11 6	7 1	5 5	10 8	7 11	4 8	4 9	2 8
September	17 0	6 8	11 8	14 5	6 8	13 5	8 5	4 3	4 5	2 5
October	7 10	8 0	11 4	8 10	6 5	6 2	8 3	4 2	4 4	2 3

(a) Weights of bags vary, but on the average are approximately as follows: For cabbages: Johannesburg, 105 lb., Cape Town 105 lb., and Durban 90 lb. For cauliflower: Johannesburg 100 lb., Cape Town 65 lb., and Durban 85 lb.

Average Prices of Oranges and Pawpaws

SEASON (1st April to 31st March).	ORANGES (Pocket).							PAWPAWS (Standard box).	
	Johannesburg.			Cape Town.		Durban.		Johannesburg.	
	N.M. Navels.	Other.							
		Navels.	Valencias.	Navels.	Valencias.	Navels.	Valencias.	N.M.	Other.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1938-39	1 10	1 6	1 5	2 0	2 1	—	—	2 0	1 7
1940-41	1 9	1 7	1 6	1 11	1 10	2 4	2 1	2 2	1 9
1941-42	1 9	1 8	2 6	1 10	2 5	1 11	2 1	2 1	1 10
1942-43	2 4	2 6	3 1	1 11	3 9	2 8	2 11	2 7	2 1
1942—									
January	—	2 6	3 8	2 10	4 7	—	3 11	3 3	2 1
February	—	3 11	4 5	4 7	6 10	3 9	5 8	6 4	3 3
March	—	3 7	2 11	6 6	5 10	4 3	5 6	4 1	3 1
April	2 1	2 0	1 10	3 4	5 0	3 4	2 6	4 0	3 1
May	2 4	2 3	2 1	2 3	2 3	2 6	1 2	3 8	3 1
June	2 3	2 3	1 9	2 1	—	2 6	1 11	2 11	2 5
July	2 5	2 5	1 11	2 1	—	2 8	1 0	2 8	2 2
August	2 11	2 8	2 8	3 0	2 4	3 6	2 4	2 2	1 8
September	2 5	3 3	2 3	3 4	2 2	4 0	2 6	2 1	1 6
October	2 9	2 11	2 7	5 1	3 1	3 7	2 11	2 4	1 9
November	—	3 6	4 0	6 11	3 7	4 6	3 6	3 1	2 6
December	—	3 1	3 8	2 11	4 3	—	4 2	3 5	2 1
1943—									
January	2 0	3 8	4 0	—	4 10	2 4	3 9	3 9	2 0
February	7 1	5 8	5 3	—	7 6	—	4 9	4 11	3 6
March	5 11	5 4	4 1	6 6	8 6	3 3	5 8	5 2	3 9
April	3 4	2 11	2 10	5 3	4 9	3 3	4 0	4 4	3 3
May	2 6	2 4	2 0	2 8	2 0	2 4	—	4 1	2 11
June	2 6	2 4	1 9	2 6	—	2 7	—	3 9	2 9
July	—	2 5	1 9	2 5	—	2 6	2 5	3 2	2 4
August	—	2 6	1 11	—	—	2 6	2 5	3 4	2 1
	Gr. I.	Gr. II	Gr. II						
September	3 1	2 10	2 2	—	—	2 7	2 6	3 3	2 4
October	2 3	3 4	2 3	—	—	—	2 5	3 0	2 5

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(*The asterisk * denotes that the article is illustrated.*)

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